I-405
CORRIDOR PROGRAM NEPA/SEPA DRAFT EIS

DRAFT TRANSPORTATION EXPERTISE REPORT

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TABLE OF CONTENTS

LIST OF APPENDICES:

LIST OF TABLES

LIST OF FIGURES

Summary

INTRODUCTION

The Transportation Expertise Report is a summary of the transportation performance of each Alternative in the I-405 Corridor. Each Alternative was evaluated based on three primary criteria to answer: How does the Alternative Improve Mobility, Reduce Congestion, and Improve Safety when compared to the No Action Alternative. The performance of each Alternative is summarized in **Table S-1**.

BACKGROUND

I-405 is the region’s dominant travel corridor east of Lake Washington, from Tukwila in the south to Lynnwood in the north. Growing traffic congestion within the corridor has the potential to create serious adverse effects on personal and freight mobility, the environment, the state and regional economy, and the quality of life. Between 1970 and 1990, employment in the study area increased over 240 percent and population grew nearly 80 percent . During the 90s employment continued to grow at an annual rate of almost 3.5 percent. During the next 20 years the population and employment is forecast to increase by more than 35 percent.

In 1970, I-405 carried 20,000 to 40,000 vehicles per day. During the next twenty years, from 1970 to 1996, the entire corridor experienced a 400 percent increase in traffic volume. WSDOT’s most recent traffic count data shows the lowest I-405 traffic volume is between SR 522 and Swamp Creek at 95,000 vehicles per day; the highest, 210,000 vehicles per day, is between I-90 and SR 520. This variation in traffic volumes is the result of different travel demands within the corridor as well as the available capacity on the freeway.

Originally built as a by-pass around Seattle, I-405 is now the roadway of choice for most north-south trips for the Eastside. More than two-thirds of the total trips on I-405 begin and end in the corridor itself. The remaining third have strong ties with the communities along SR 167 to the south of the study area, and with developing areas to the east within the urban growth area of King County. Travel demand in the corridor is expected to generally follow the region’s trend of a greater than 50 percent increase in person trips between 1995 and 2020. I-405 typically carries 60 to 70 percent of the total daily traffic volumes passing through the study area in the north-south direction. Conversely, the arterial streets carry 30 to 40 percent.

The I-405 corridor includes a significant number of arterial streets maintained by local jurisdictions including Bellevue, Kirkland, Renton, Newcastle, Tukwila, Woodinville, and Bothell. The overall Eastside arterial street network is not very dense. This provides fewer lanes to carry general-purpose traffic and transit. In addition, much of the adjacent arterial system is discontinuous because of topography and development patterns. I-405 currently carries a large number of non-regional trips, while traffic congestion on arterial streets remains severe.

Today, several portions of I-405 already experience more than five hours of congestion per day in one direction. The most congested area of I-405, from I-5 in Tukwila to NE Park Drive in Renton, typically experiences up to 12 hours of congestion per day. The traffic congestion on I-405 often results in blockage of mainline flows throughout the day by vehicles that cannot get onto the ramps. This congestion also causes traffic to spill over onto local arterials.

Travel times vary widely within the I-405 study area, depending upon the origin and destination of the trip and the mode of travel being used. The fastest trips are typically by HOV mode. Traveling along the full length of I-405 during the peak period can take longer than one hour for general traffic. Travel time reliability is a problem mostly in the morning peak period; but occasionally in the PM peak period.

PERFORMANCE EVALUATION

The I-405 Corridor Program is a corridor-level study and does not focus on specific design detail or precise footprints for each of the nearly 300 projects that have been considered. Therefore, the transportation performance of each Alternative was evaluated as a package of improvements. This corridor level of analysis is appropriate and meaningful for evaluating effects on mobility, transportation performance, and environmental quality across such a large area.

Criteria and Performance Measures

Three primary criteria were used to measure the transportation performance of the four Alternatives under consideration in the I-405 Corridor Study. These criteria were:

- **Mobility:** How does the Alternative improve mobility for the travelers along I-405?
- **Congestion:** How does the Alternative reduce congestion in the Corridor?
- **Safety:** How does the Alternative improve safety for travelers in the Corridor?

The performance of each Alternative was compared to the performance conditions under the No Action Alternative. The results of these analyses are detailed in **Table S-1,** and in the following sections of this report.

Does the Alternative Improve Mobility in the Corridor?

This criterion measured the effect of each Alternative on the mobility of travelers in the corridor. The performance measures used were:

1. How does the Alternative meet the 2020 peak period travel demand in the corridor?

- What happens to the daily person volumes and PM peak period volumes by mode?
- What is the effect on vehicle volumes (daily traffic volume shifts between facilities; changes in traffic volume by vehicle both for daily and PM peak periods)?

2. How does the Alternative improve the predictability of travel time for each mode of travel?

3. Can this Alternative accommodate increases in volume (in all modes) beyond 2020 (the study planning horizon)?

4. Do the travel times improve for the modes compared to current conditions (1995)?

5. Does the Alternative reduce the number of single occupant vehicles (SOVs) on I-405; and as a result, do the improvements and strategies reduce the SOV share of the daily and peak period trips?

6. How compatible is the Alternative with the regional and local transportation systems? Do local and regional plans and policies support the Alternative?

Does the Alternative Reduce Congestion in the Corridor?

1. How do the hours of congestion on I-405 and other roadways compare with current conditions?

Does the Alternative Improve Safety for Travelers in the Corridor?

1. Does the Alternative improve the high accident locations?

2. Does the Alternative decrease the potential for traffic accidents throughout the I-405 Corridor?

Table S-1: Summary of Alternative Performance

	Improve Mobility	Reduce Congestion	Improve Safety
No Action	**Travel Demand**- Serves 21% more trips within the corridor compared to 1995, lowest of any alternative. **Travel Time**- General traffic times would increase by 30%; HOV trips increase by 20%; Transit travel times increase by around 5% compared to 1995. **Mode Shares**- Transit and HOV shares increase compared to 1995.	**Hours of Congestion** – Congestion worsens by 1 to 4 hours along I-405, and up to 2 hours a day more on other freeway and arterial facilities. **Vehicle Hours of Travel (VHT)**- increase by 100% or more compared to 1995, while average speeds drop significantly on I-405 and other study area facilities.	**Accident Hot Spots**- Some high accident locations are improved by committed projects. **Total Accidents**- increase in proportion to growth in travel to 2020. Accident rates increase since more travel shifts to less safe arterial routes.

	Improve Mobility	Reduce Congestion	Improve Safety
Alternative 1	**Travel Demand**- Minimal change from No Action. **Travel Time**- HOV and General traffic times minimal change from No Action; Transit travel times improve significantly with High Capacity Transit. **Mode Shares**- Transit usage increases throughout corridor. HOV stays about the same. **Transportation Demand Management (TDM)** actions would encourage more transit and HOV use. **Pricing Strategies** offer significant potential for mode shifts, although effects not fully quantified.	**Hours of Congestion** – No change in congestion compared to No Action. **Average Travel Speeds** stay about the same as No Action, with minimal changes in total Vehicle Miles and Hours of Travel. **TDM** program could help decrease total miles and hours traveled.	**Accident Hot Spots**- Several high accident locations are improved along I-405. • **Nonmotorized** hazard locations across I-405 also improved. **Total Accidents** show minimal change from No Action.
Alternative 2	**Travel Demand**- Handles 15-20% more demand than No Action. Results in some shifting from other corridors to I-405. **Travel Time**- HOV improves slightly from No Action; General traffic travel times improved up to 10% from No Action; Transit travel times improve significantly with High Capacity Transit. **Mode Shares**- Transit usage increases throughout corridor (same as Alternative 1). HOV stays about the same. **TDM** actions would encourage more transit and HOV use.	**Hours of Congestion** – Congestion improves by around 1 hour per day for all facilities. Some I-405 segments improve by 3-5 hours. **Vehicle Hours of Travel (VHT)**- increase slightly due to added corridor travel, while **Average Travel Speeds** improve. **TDM** program could help decrease hours and miles of travel.	**Accident Hot Spots**- Several high accident locations are improved along I-405. • **Nonmotorized** hazard locations across I-405 also improved. **Total Accidents** decrease slightly from No Action, even though travel increases. Accident rates decrease due to shift from arterials to I-405 and some reduction in congestion levels.

	Improve Mobility	Reduce Congestion	Improve Safety
Alternative 3	**Travel Demand**- Handles 25-30% more demand than No Action. I-405 demand increases by 75%. Results in shifting from other corridors to I-405. **Travel Time**- General traffic travel times improved up to 15% from No Action; Transit travel times improve significantly with High Capacity Transit (slightly less improvement than Alternatives 1 and 2). **Mode Shares**- Transit usage increases throughout corridor (similar to Alternatives 1 and 2). HOV stays about the same. **TDM** actions would encourage more transit and HOV use.	**Hours of Congestion** – Congestion improves on I-405 by around 3 hours per day (better than current freeway conditions). Other facilities improve up to 1 hour. Some I-405 segments improve by 5-8 hours. **Average Travel Speeds-** improve despite increases in total Vehicle Miles and Hours of Travel. **TDM** program could help decrease total miles and hours traveled.	**Accident Hot Spots**- Several high accident locations are improved along I-405 and other study area routes. • **Nonmotorized** hazard locations across I-405 also improved. **Total Accidents-** decrease from No Action despite large increase in overall travel. Accident rates decrease due to shift from arterials to I-405, reduction in congestion levels, and reconstruction of facilities to better design standards.
Alternative 4	**Travel Demand**- Handles 30-35% more demand than No Action. I-405 demand increases by up to 85%. Results in substantial shifting from other corridors to I-405. **Travel Time**- General traffic travel times improved up to 20% from No Action; Transit travel times improve by 2 to 4% with minimal new transit facilities. **Mode Shares**- Transit and HOV usage stays about the same as No Action. SOV usage shows an increase from No Action. **TDM** actions would encourage more transit and HOV use, but would be less than Alternatives 1,2 or 3.	**Hours of Congestion** – Congestion improves on I-405 by around 4 hours per day (better than current freeway conditions). Other facilities improve up to 2 hours. Some I-405 segments improve by 5-8 hours. **Average Travel Speeds-** improve substantially despite increases in total Vehicle Miles and Hours of Travel. **TDM** program could help decrease total miles and hours traveled.	**Accident Hot Spots**- Several high accident locations are improved along I-405 and other study area routes. • **Nonmotorized** hazard locations across I-405 also improved. **Total Accidents-** decrease from No Action despite large increase in overall travel. Accident rates decrease due to shift from arterials to I-405, reduction in congestion levels, and reconstruction of facilities to better design standards.

	Improve Mobility	Reduce Congestion	Improve Safety
Summary Comments	**Alternatives 3 and 4** accommodate the highest corridor travel demand and achieve the best travel time savings for general traffic. **Alternatives 1,2 and 3** attract the highest transit ridership and have similar transit travel time savings. **HOV usage and travel times** are relatively constant among alternatives. **TDM strategies** will benefit each of the build alternatives, while pricing effects are unique to Alternative 1.	**Alternatives 3 and 4** provide the largest improvement in congestion levels **Alternative 1** provides little or no congestion relief, but does the most to reduce overall vehicle hours and miles of travel.	**Each build alternative** makes basic improvements on I-405 to benefit safety. **Alternatives 2,3 and 4** provide progressively better safety levels in the study area through improved physical/operational design on I-405, reduction in congestion levels, and concentration of travel along the safer freeway corridors.

Note: HOV is defined as three or more persons in a vehicle.

1. Alternatives Description

1.1 INTRODUCTION

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1.1.1 Report Organization and Scope

This report presents an evaluation of the traffic and transportation-related improvements of five Alternative approaches and the potential impacts to the in the Interstate 405 (I-405) corridor. The analysis has been conducted at the corridor level and represents a programmatic, rather than project-level assessment of impacts. The report addresses the potential impacts of each of the four proposed action Alternatives as well as a No Action Alternative.

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1.1.2 I-405 Corridor Program Overview

Construction of the 30-mile Interstate 405 (I-405) freeway in the early 1960s as a bypass around Seattle for Interstate 5 (I-5) traffic also opened the rural, agricultural countryside east of Lake Washington to commercial and residential development. Interstate 405 currently ranges from six to ten lanes along the 30-mile corridor, and it is the designated military route through Seattle, as Interstate 5 was deemed too constricted (see **Figure 1-1**). Construction of the Evergreen Point (SR 520) floating bridge in 1963 further set the stage for rapid and substantial changes on the Eastside.

Today, I-405 has changed dramatically from a Seattle bypass to become the region's dominant north-south travel corridor east of I-5. More than two-thirds of the total trips on I-405 begin and end in the corridor itself. The remaining third have strong ties with the communities along SR 167 to the south of the study area, and with developing areas to the east within the urban growth area of King County. However, as the regional importance of the I-405 corridor has grown, it has become increasingly evident that worsening traffic congestion within the corridor has the potential to create serious adverse effects on personal and freight mobility, the environment, the state and regional economy, and the quality of life.

In response to these and other concerns, the Washington State Department of Transportation (WSDOT) has joined with the Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Central Puget Sound Regional Transit Authority (Sound Transit), King County, and local governments to develop strategies to reduce traffic congestion and improve mobility in the I-405 corridor from Tukwila in the south to Lynnwood in the north.

The I-405 Corridor Program is a cooperative effort involving over 30 agencies that have responsibilities for planning, regulating, and implementing transportation improvements in the

250+ square-mile corridor. The decision to be made through the combined National Environmental Policy Act / State Environmental Policy Act EIS policy is to identify the best mix of modal solutions, transportation investments, and demand management to improve movement of people and goods throughout the I-405 corridor, reduce foreseeable traffic congestion, and satisfy the overall program purpose and need.

The programmatic I-405 Corridor Program EIS will focus on broad corridor-wide issues related to travel mode and transportation system performance. This is consistent with the program objective to enable program decisions focusing on mode choice, corridor selection, general location of improvements, and how combinations of improvements may function together as a system to solve corridor-wide transportation problems. A programmatic level of analysis is appropriate and necessary at this early stage in the decision-making process, when many project-level design details would not be meaningful in evaluating effects on mobility and environmental quality across such a large area. Subsequent environmental analysis, documentation, and review will be prepared to enable decisions regarding site-specific, project-level details on alignments, high-capacity transit technology, project impacts, costs, and mitigation measures after a preferred Alternative has been identified.

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1.1.3 Need For the Proposed Action

The need identified for the I-405 Corridor Program is:

> To improve personal and freight mobility and reduce foreseeable traffic congestion in the corridor that encompasses the I-405 study area from Tukwila to Lynnwood in a manner that is safe, reliable, and cost-effective.

The following sub-sections expand upon the issues and trends that influence the need for the proposed action, particularly with respect to travel demand and traffic congestion, and the attendant effects on freight mobility and safety.

1.1.3.1 Growth in Travel Demand

Between 1970 and 1990, communities in the I-405 corridor grew much faster than the central Puget Sound region as a whole. During the 20-year period, employment in the affected area increased over 240 percent from 94,500 to 323,175 and population grew nearly 80 percent from 285,800 to 508,560.

Population and employment continued to grow during the 1990s; in particular, employment grew at an annual rate of almost 3.5 percent. Looking ahead, growth in the corridor through 2020 likely will keep pace with the robust rate of growth in the Puget Sound region. The I-405 corridor population and employment is forecast to increase by more than 35 percent. This means that by 2020 an additional 144,000 people are expected to be employed within the study area, while the population is expected to reach approximately 765,000, an increase of more than 200,000 people from 1997.

Travel demand trends in the I-405 corridor match these population and employment trends: between 1995 and 2020, person trips are generally expected to increase more than 50 percent.

Travel demand in terms of traffic volume is heaviest within the study area on I-405 itself, with the freeway carrying 60 to 70 percent of the total daily traffic volumes passing though the study area in the north-south direction. Conversely, the arterial streets carried 30 to 40 percent. A more detailed summary of travel demand trends, including discussion of mode split and trip characteristics follows in Chapter 3, The Affected Environment.

1.1.3.2 Traffic Congestion

Today, several portions of I-405 already experience more than five hours of congestion per day in one direction. The most congested area of I-405, from I-5 in Tukwila to NE Park Drive in Renton, typically experiences up to 12 hours of congestion per day.

Traffic congestion on I-405 often results in blockage of mainline flows throughout the day by vehicles that cannot get onto the ramps at such locations as SR 167, I-90, SR 520, and SR 522. The spillover traffic from the ramps has created significant mainline traffic congestion and operational hazards throughout the I-405 corridor. This congestion also causes traffic to spill over onto local arterials.

Heavy travel demand and frequent traffic incidents contribute to substantial traffic congestion on I-405, although they are not the only causes. In Chapter 3, a detailed analysis examines the relationship of congestion to travel times and reliability in the I-405 Corridor.

1.1.3.3 Freight Mobility

The decreasing reliability of the regional transportation system, including I-405, is creating a serious problem for regional freight mobility. The central Puget Sound region serves as an important freight gateway to Pacific Rim countries. Automobiles, forest and agricultural products, communications and computer equipment, and hundreds of other items continuously move over the region’s roadways and railroads, to seaports and airports. Substantial delay as a result of transportation system congestion is costing the region’s businesses nearly $700 million a year, according to information from WSDOT. The cost to the freight industry itself is estimated to be around $200 million per year.

Products shipped by truck across I-90 from Eastern Washington reach points north and south of Seattle via I-405. At the same time, I-405 serves as a heavily used transport corridor for local freight delivery to and from the cities along the corridor. Smaller trucks, such as delivery vans, account for many freight trips within the region, and these trips could benefit greatly from roadway improvements to I-405.

Interstate 405 continues to be used by freight carriers as an Alternative to the preferred I-5 route when severe congestion occurs on I-5 in downtown Seattle near the Convention Center (one of the most substantial freight mobility bottlenecks in the region). I-405 also provides ready access to the distribution centers along SR 167 in the Kent Valley. Volumes of heavy trucks on the portion of I-405 south of I-90 are about double those along the northern portion due to truck movements to and from the Kent Valley. Truckers identify congestion at the SR 167/I-405 interchange as one of the worst transportation system problems in the region, and the trucking community supports improvements to this major truck corridor interchange as one of its top priorities.

The latest data indicate that the central Puget Sound region's roadways carry approximately 1.2 million truck trips each day, with about 70 percent of those trips occurring within King County. I-405 carries a substantial portion of those trips, moving up to 90 percent of the total truck origins and destinations in east King County. Truck volumes along I-405 are expected to grow by 50 percent by the year 2010. Reductions in system reliability and resulting higher transportation costs increase the cost of manufacturing and distributing goods, while adversely affecting economic vitality and job creation. Accessibility to markets becomes increasingly difficult with worsening traffic congestion and delay. Improvements to the I-405 corridor could provide tangible economic benefits for all of Washington State.

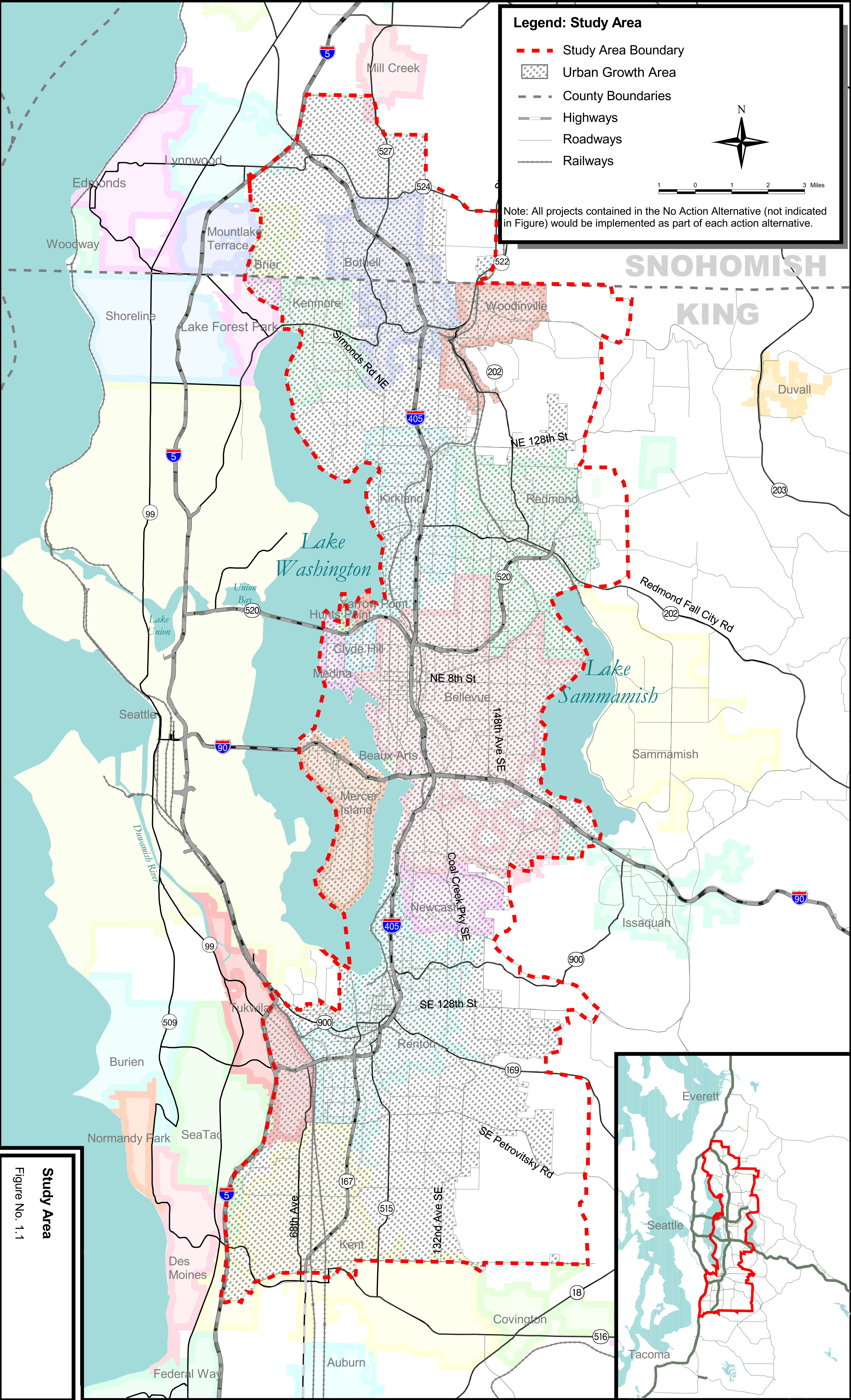
1.3.3.4 Safety

Twenty-nine of the 280 high accident locations in King and Snohomish counties are located along I-405. Most high accident locations are associated with ramps connecting to I-405, including those at SR 181 (Interurban), SR 169, SR 900 (Sunset and Park), Coal Creek Parkway, SE 8th Street, NE 4th Street, NE 8th Street, SR 908 (NE 85th Street), NE 116th Street, NE 160th Street, and SR 527. The portion of I-405 north of SR 527 is identified as a high accident corridor due to the relatively higher speeds and more serious injuries associated with these accidents.

Over the three-year period from 1994 to 1996, a total of 5,580 accidents was reported along I-405. Most collisions occurred on the mainline freeway, with about one-fourth of all accidents occurring on the ramps, collector-distributor roads, and cross streets at the interchanges. About half of all collisions involve property damage only, while half involve injuries or fatalities. This injury pattern applies equally to the mainline and ramp segments; however, all seven fatalities reported in this period occurred on the I-405 mainline.

The overall accident rate along I-405 (1.6 accidents per million vehicle miles) is about midrange compared to other freeways in King County. The rates are lower than the average rate for all state highways (1.88 accidents per million vehicle miles, or MVM) and for state highways in King County (2.27 accidents per MVM). On comparable local freeways, I-5 and SR 520 both exhibit accident rates of about 2.0 accidents per MVM. WSDOT's ramp metering program on I-405 has been very successful. Rear-end and sideswipe accidents have decreased by 60 percent to 70 percent near locations with ramp meters.

For state roads serving as surface arterial routes, accident rates typically fall into the range of three to five accidents per MVM. This rate is related to the presence of traffic signals, driveways, pedestrians, and bicyclists, and lower levels of access control. These accident rates are typical of urban arterial facilities. Accident rates for selected arterial and collector routes in the primary study area generally range between two and four accidents per MVM, with some streets higher. These streets also experience higher accident rates due to the presence of signalized intersections, driveways, and other conflicts.



Study Area

Figure No. 1.1

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1.1.4 Purpose of the Proposed Action

The purpose of the proposed action is:

> To provide an efficient, integrated, and multi-modal system of transportation solutions within the corridor that meets the need in a manner that:
>
> - Provides for maintenance or enhancement of livability for communities within the corridor;
> - Provides for maintenance or improvement of air quality, protection or enhancement of fish-bearing streams, and regional environmental values such as continued integrity of the natural environment;
> - Supports a vigorous state and regional economy by responding to existing and future travel needs; and
> - Accommodates planned regional growth.

1.1.5 Study Area

The study area for the I-405 Corridor Program defines the general boundaries of the I-405 corridor and encompasses the essential improvements proposed within each alternative. It encompasses an area of approximately 250 square miles that extends on both sides of I-405 between its southern intersection with I-5 in the city of Tukwila and its northern intersection with I-5 in Snohomish County. This area includes the cities of Tukwila, Renton, Newcastle, Bellevue, Redmond, Kirkland, Woodinville, and Bothell, as well as portions of the cities of Issaquah, Kenmore, Kent, Lynnwood, and Mercer Island and adjacent unincorporated areas of King and Snohomish counties.

For purposes of environmental analysis, documentation, and review, potential substantial adverse effects are identified and evaluated wherever they are reasonably likely to occur in the region.

1.2 DESCRIPTION OF ALTERNATIVES

Four programmatic Action Alternatives and a No Action Alternative are evaluated in this report. Each of the four Action Alternatives is a combination of multi-modal transportation improvements and other mobility solutions packaged to work together as a system. Each package demonstrates a unique emphasis in response to the purpose and need for the I-405 Corridor Program. The improvements and mobility solutions that comprise each action Alternative are assembled from the following major elements:

- Transportation demand management (TDM)
- Regional transportation pricing
- Local transit service (bus and other technologies)
- Bus rapid transit (BRT) operating in improved-access high-occupancy vehicle lanes on I-405, I-90, and SR 520
- Fixed-guideway high-capacity transit (HCT) operating with physical separation from other transportation modes
- Arterial high-occupancy vehicle (HOV) and bus transit priority improvements
- HOV express lanes on I-405 and HOV direct access ramps
- Park-and-ride capacity expansions
- Transit center capacity improvements
- Basic I-405 safety and operational improvements
- I-405 general-purpose lanes
- I-405 collector-distributor lanes
- I-405 express lanes
- SR 167 general-purpose lanes
- Capacity improvements on freeways connecting to I-405
- Planned arterial improvements
- Capacity improvements on north-south arterials
- Arterial connections to I-405
- Pedestrian and bicycle improvements
- Intelligent transportation system (ITS) improvements
- Truck freight traffic enhancements

These elements are described in greater detail in **Appendix A** (Major Elements of Alternatives). **Table 1-1** shows the system elements contained in each Alternative.

Table 1-1: System Elements Contained in Each Alternative

	No Action Alternative	Alternative 1 HCT/TDM Emphasis	Alternative 2 Mixed Mode with HCT/Transit Emphasis	Alternative 3 Mixed Mode Emphasis	Alternative 4 General Capacity Emphasis
Committed and funded freeway projects	X	X	X	X	X
Committed and funded HOV projects	X	X	X	X	X
Committed and funded arterial projects	X	X	X	X	X
Park–and-ride expansions included in No Action	X	X	X	X	X
Transit center improvements included in No Action	X	X	X	X	X
Transportation Demand Management (TDM)	X	X	X	X	X
Expanded TDM regional congestion pricing strategies		X			
Expand transit service by 100% compared to K. Co. 6-year plan		X	X	X	
Expand transit service by 50% compared to K. Co. 6-year plan					X
Physically separated, fixed-guideway HCT system		X	X		
Bus rapid transit operating in improved access HOV lanes				X	
Arterial HOV priority for transit		X	X	X	
HOV direct access ramps on I-405			X	X	X
Additional park-and-ride capacity expansion		X	X	X	
Additional transit center improvements		X	X	X	
Basic I-405 safety and operational improvements		X	X	X	X
I-405/ SR 167 interchange ramps for all major movements			X	X	X
One added general-purpose lane in each direction on I-405			X		X
Two added general-purpose lanes in each direction on I-405				X	

	No Action Alternative	Alternative 1 HCT/TDM Emphasis	Alternative 2 Mixed Mode with HCT/Transit Emphasis	Alternative 3 Mixed Mode Emphasis	Alternative 4 General Capacity Emphasis
Two express lanes added in each direction on I-405 [a]					X
Widen SR 167 by one lane each direction to study area boundary			X	X	X
Improved capacity of freeways connecting to I-405			X	X	X
Planned arterial improvements			X	X	X
Complete missing segments of major arterial connecting routes [b]				X	
Expand capacity on north-south arterials [b]					X
Upgrade arterial connections to I-405 [b]			X	X	X
Pedestrian / bicycle connections and crossings of I-405		X	X	X	X
Intelligent transportation system (ITS) improvements		X	X	X	X
Truck freight traffic enhancements		X	X	X	

[a] To be studied as general-purpose lanes and as managed high-occupancy/toll (HOT) lanes.
[b] With jurisdictional approval.

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1.2.1 No Action Alternative

The No Action Alternative includes the funded highway and transit capital improvement projects of cities, counties, Sound Transit, and WSDOT. These projects are already in the pipeline for implementation within the next six years, and are assumed to occur regardless of the outcome of the I-405 Corridor Program. For this reason, they are referred to collectively as the No Action Alternative.

Under the No Action Alternative, only limited expansion of state highways would occur. No expansion of I-405 is included; however, a new southbound I-405 to southbound SR 167 ramp modification would be constructed. Approximately 15 arterial widening and interchange improvement projects would be implemented within the study area by local agencies. Short-term minor construction necessary for continued operation of the existing transportation facilities would be accomplished, and minor safety improvements would be constructed as required.

It is assumed that Phase I of Sound Transit's regional transit plan would be completed. Approximately 36 HOV direct access projects, arterial HOV improvements, park-and-ride expansions, and transit center enhancements would be implemented in the study area as part of the No Action Alternative. Bus transit service levels by the 2020 horizon year are based upon the Puget Sound Regional Council (PSRC) Metropolitan Transportation Plan. A 20 percent increase in bus transit service hours above the current King County 6-year plan level is assumed by year 2020. Parking costs are expected to increase due to market forces. Additional urban centers and major employment centers within the study area are also assumed to implement parking charges by 2020.

These baseline transportation improvement projects are, or will be, the subject of separate and independent project-specific environmental analysis, documentation, and review. Their direct impacts are not specifically evaluated by the I-405 Corridor Program. However, the secondary and cumulative impacts of these projects are, addressed as part of the analyses contained herein.

Figure 1-2 shows the locations of the improvements contained in the No Action Alternative. **Appendix B** (Alternatives Project Matrix) identifies the specific transportation improvements and mobility solutions contained within each system element and alternative.

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1.2.2 Alternative 1: High-Capacity Transit/TDM Emphasis

This Alternative attempts to minimize addition of new impervious surface from general-purpose transportation improvements and to encourage transit use within the study area. To do this, Alternative 1 emphasizes reliance on a new physically separated fixed-guideway HCT system, substantial expansion of local bus transit service, non-construction mobility solutions such as regional transportation pricing, and transportation demand management (TDM) strategies. It does not include any increase in roadway capacity beyond the No Action Alternative. All improvements contained in the No Action Alternative are included in Alternative 1, as well as in the other action Alternatives. Table 1-1 shows the system elements contained in each of the Alternatives.

Alternative 1 includes a physically separated, fixed-guideway HCT system, potentially using some form of rail technology and potentially operating within portions of the existing Burlington Northern Santa Fe (BNSF) right-of-way. The HCT system would serve the major activity centers within the study area, and would include connections to Redmond and Issaquah and west across Lake Washington to Seattle. The connection across Lake Washington is being evaluated as part of the ongoing Trans-Lake Washington Project EIS. Bus transit service would be doubled compared to the current King County 6-year plan. (The effects of recent transit reductions on short-term transit service have not been assumed.) Arterial HOV priority for transit, additional park-and-ride capacity, and additional transit center improvements also would be provided.

A package of basic improvements to I-405 would be implemented, including climbing lanes, auxiliary lanes, I-90/Coal Creek interchange improvements, and I-405/SR 167 interchange improvements, among others. No additional general-purpose lanes on I-405 would be provided.

Limited arterial HOV/transit improvements would be provided to facilitate access to I-405 and the fixed-guideway HCT system, along with non-construction treatments such as providing priority for transit at signals and intersections. Regional pricing strategies similar to those currently being studied by the Puget Sound Regional Council (PSRC) would be implemented along with a package of core TDM strategies that are common to all the action Alternatives.

Figure 1-3 shows the location of improvements contained in Alternative 1. Appendix A (Major Elements of Alternatives) describes the system elements that are the building blocks for the Alternatives. Appendix B (Alternatives Project Matrix) identifies the specific transportation improvements and mobility solutions contained within each system element and alternative.

1.2.3 Alternative 2: Mixed Mode with High-Capacity Transit/Transit Emphasis

This Alternative attempts to improve mobility options in the study area relative to Alternative 1 by providing the same substantial commitment to transit, combined with the minimum increase in roadway capacity for HOV and general-purpose traffic. To do this, Alternative 2 would implement a new physically separated, fixed-guideway HCT system, substantial expansion of local bus transit service, one added lane in each direction on I-405, and improvements to connecting arterials. All improvements contained in the No Action Alternative are included in Alternative 2, as well as in the other action Alternatives. Table 1-1 shows the system elements contained in each of the Alternatives.

Alternative 2 includes a physically separated, fixed-guideway HCT system, potentially using some form of rail technology. The HCT system would serve the major activity centers within the study area, and would include connections to Redmond and Issaquah and west across Lake Washington to Seattle. The connection across Lake Washington is being evaluated as part of the ongoing Trans-Lake Washington Project EIS. Bus transit service would be doubled compared to the current King County 6-year plan. Arterial HOV priority for transit, additional park-and-ride capacity, and additional transit center improvements are included, as well as completion of the HOV freeway-to-freeway ramps along I-405.

To increase general-purpose capacity, I-405 would be widened by one lane in each direction. One lane also would be added in each direction on SR 167 to the study area boundary. The package of basic improvements to I-405 would be implemented, along with the core TDM strategies that are common to all action Alternatives. New capacity improvements on connecting arterials and freeways would be provided along with planned arterial improvements of local jurisdictions.

Figure 1-4 shows the location of improvements contained in Alternative 2. Appendix A (Major Elements of Alternatives) describes the system elements for the Alternatives. Appendix B (Alternatives Project Matrix) identifies the specific transportation improvements and mobility solutions contained within each system element and alternative.

1.2.4 Alternative 3: Mixed Mode Emphasis

This Alternative attempts to substantially improve mobility options for all travel modes and to provide a HCT system throughout the study area at a lower cost than the physically separated, fixed-guideway system proposed in Alternatives 1 and 2. To do this, Alternative 3 would implement a new bus rapid transit (BRT) system, substantial expansion of local bus transit service, two added lanes in each direction on I-405, and improvements to arterials within the study area. All improvements contained in the No Action Alternative are included in Alternative

3, as well as in the other action Alternatives. Table 1-1 shows the system elements contained in each of the Alternatives.

Alternative 3 includes a BRT system operating in improved-access HOV lanes on I-405, I-90, and SR 520. The BRT system would serve the major activity centers within the study area, and would include connections to Redmond and Issaquah and west across Lake Washington to Seattle. The connection across Lake Washington is being evaluated as part of the ongoing Trans-Lake Washington Project EIS. Bus transit service would be doubled compared to the current King County 6-year plan. Improved arterial HOV priority for transit, park-and-ride capacity, transit center improvements, and HOV direct access are included, as well as completion of the HOV freeway-to-freeway ramps along I-405.

This Alternative would substantially increase capacity for general-purpose traffic on I-405 by adding two lanes in each direction and improving major interchanges. These added general-purpose lanes replace most of the auxiliary and climbing lanes contained in the package of basic improvements to I-405 that are common to the other action Alternatives. One lane would be added in each direction on SR 167 to the study area boundary. The core TDM strategies would be implemented. New capacity improvements on connecting arterials and freeways would be provided. Selected arterial missing links would be completed together with planned arterial improvements of local jurisdictions.

Figure 1-5 shows the location of improvements contained in Alternative 3. Appendix A (Major Elements of Alternatives) describes the system elements for the Alternatives. Appendix B (Alternatives Project Matrix) identifies the specific transportation improvements and mobility solutions contained within each system element and alternative.

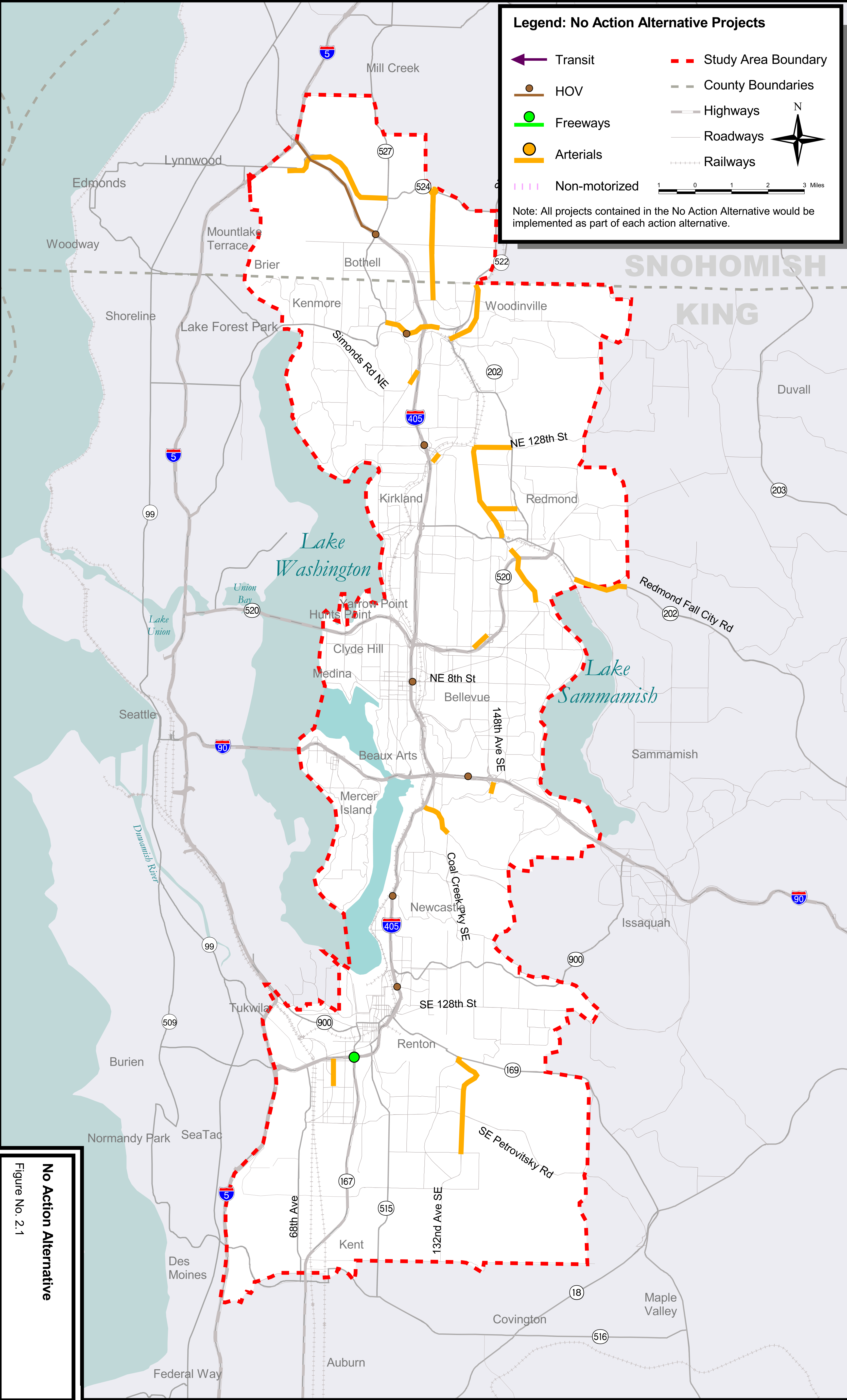
1.2.5 Alternative 4: General Capacity Emphasis

This Alternative places the greatest emphasis on increasing general-purpose and HOV roadway capacity, with substantially less reliance on new transit facilities or added local bus service than any of the other action Alternatives. To do this, Alternative 4 would provide one additional lane in each direction on I-405, a new four-lane I-405 express roadway, and the other general-purpose and HOV roadway improvements on I-405 and connecting freeways contained in Alternative 3. The expansion of local bus transit service would be about half that proposed under the other action Alternatives. All improvements contained in the No Action Alternative are included in Alternative 4, as well as in the other action Alternatives. Table 1-1 shows the system elements contained in each of the Alternatives.

Alternative 4 would expand freeway capacity by adding one additional general-purpose lane in each direction on I-405 in most segments, improving major interchanges, and constructing a new four-lane I-405 express roadway consisting of two lanes in each direction with limited access points. Completion of the HOV freeway-to-freeway ramps along I-405 and the package of basic improvements to I-405 would be implemented.

Arterial improvements would include additional expansion of major arterial routes and connections to I-405 in conjunction with the planned arterial improvements of local jurisdictions. Transit in this Alternative is assumed to be a continuation of the existing local and express bus transit system with a 50 percent increase in service compared to the current King County 6-year plan. Park-and-ride capacity would be provided along with the core TDM strategies that are common to all action Alternatives.

Figure 1-6 shows the location of improvements contained in Alternative 4. Appendix A (Major Elements of Alternatives) describes the system elements for the Alternatives. Appendix B (Alternatives Project Matrix) identifies the specific transportation improvements and mobility solutions contained within each system element and alternative.



No Action Alternative

Figure No. 2.1

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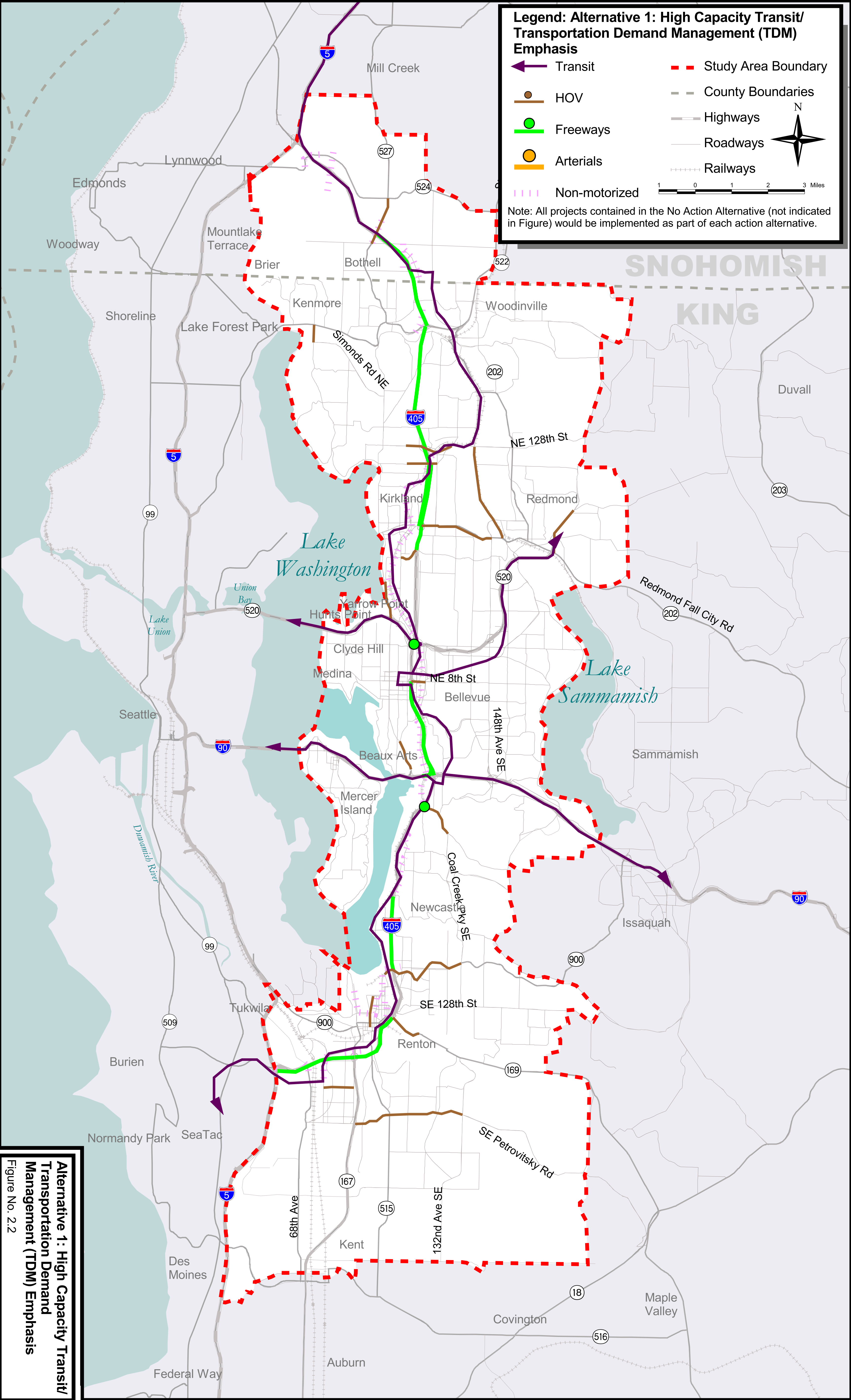

Alternative 1: High Capacity Transit/ Transportation Demand Management (TDM) Emphasis

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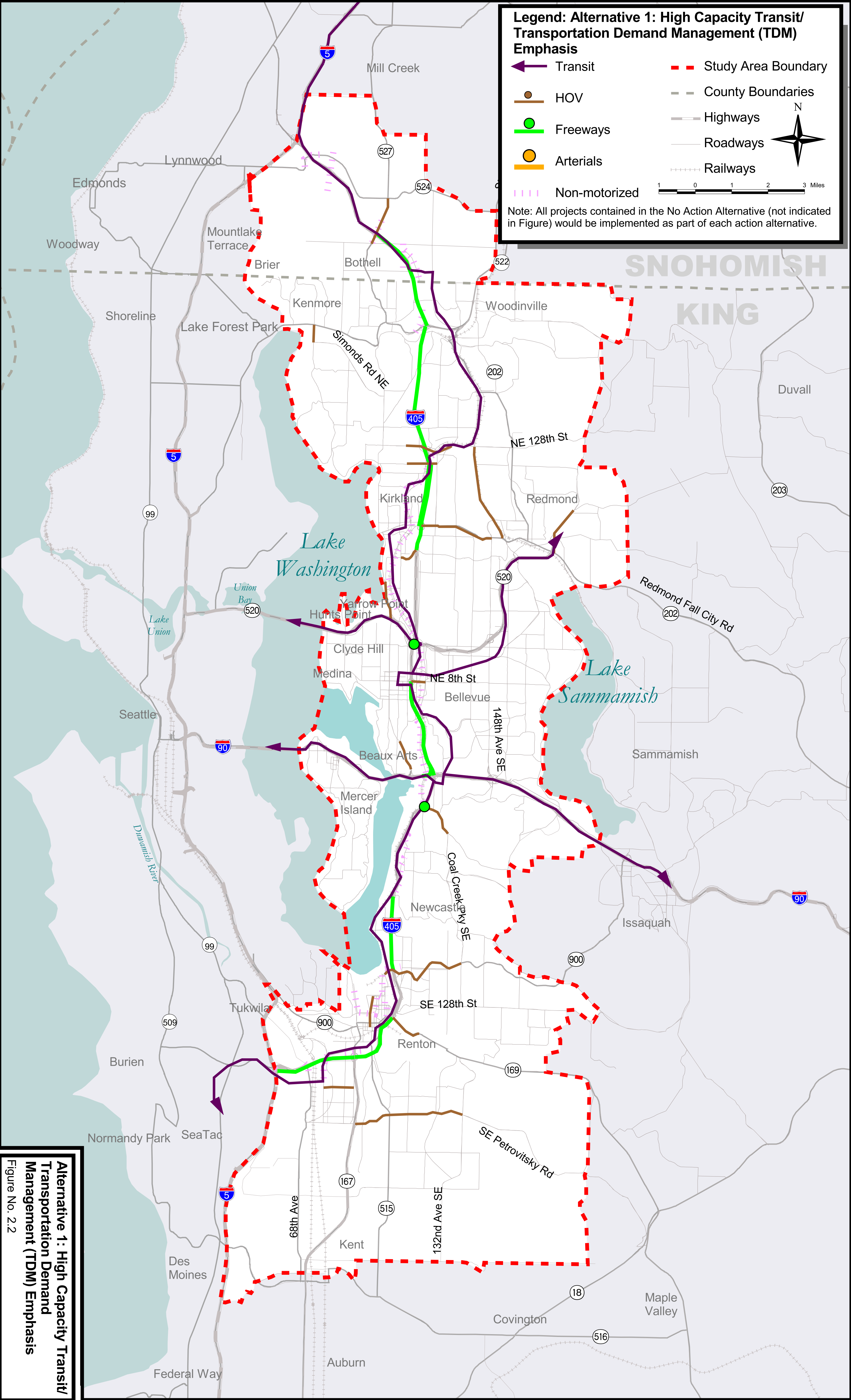

Alternative 1: High Capacity Transit/ Transportation Demand Management (TDM) Emphasis

Figure No. 2.2

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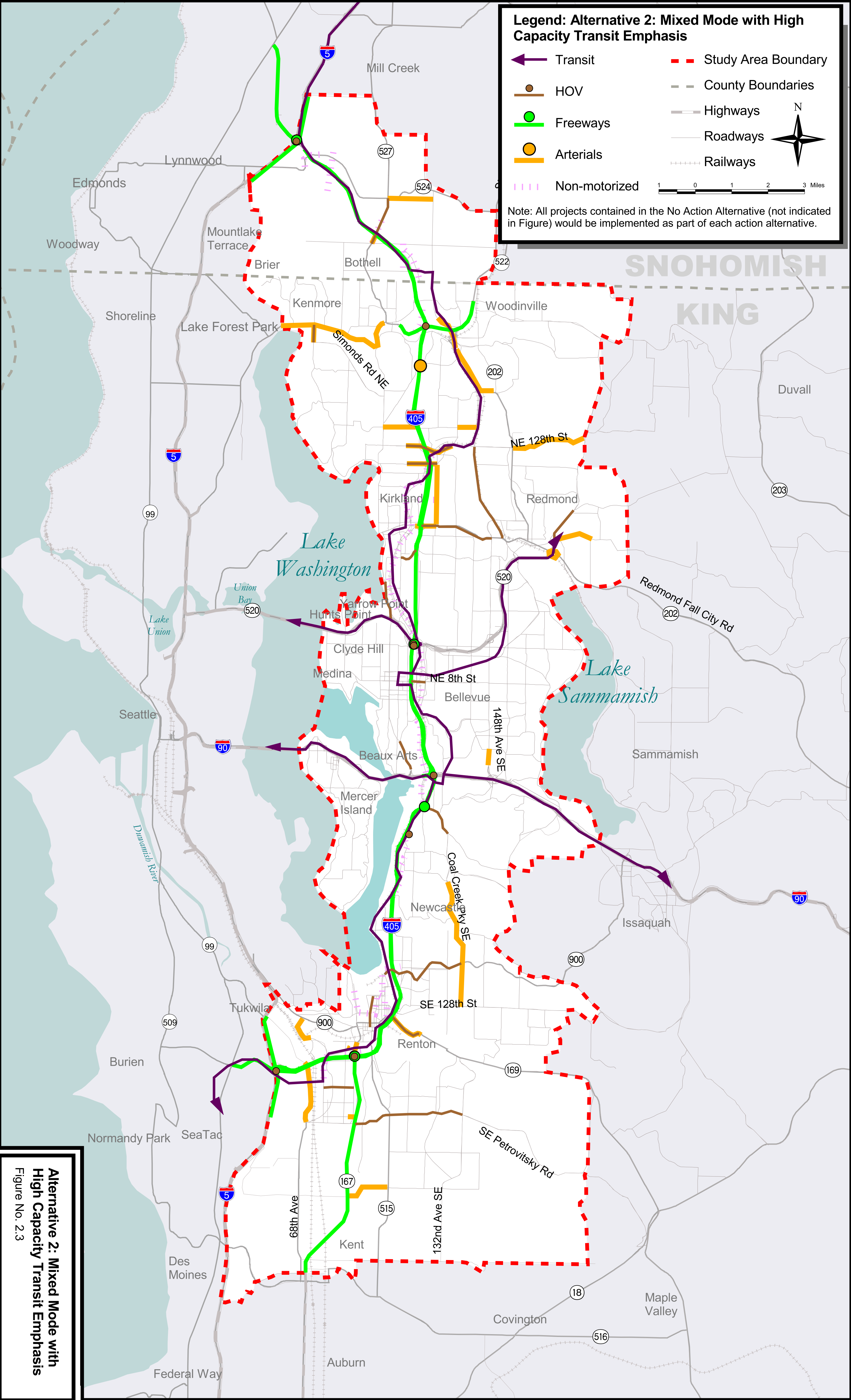

Alternative 2: Mixed Mode with High Capacity Transit Emphasis

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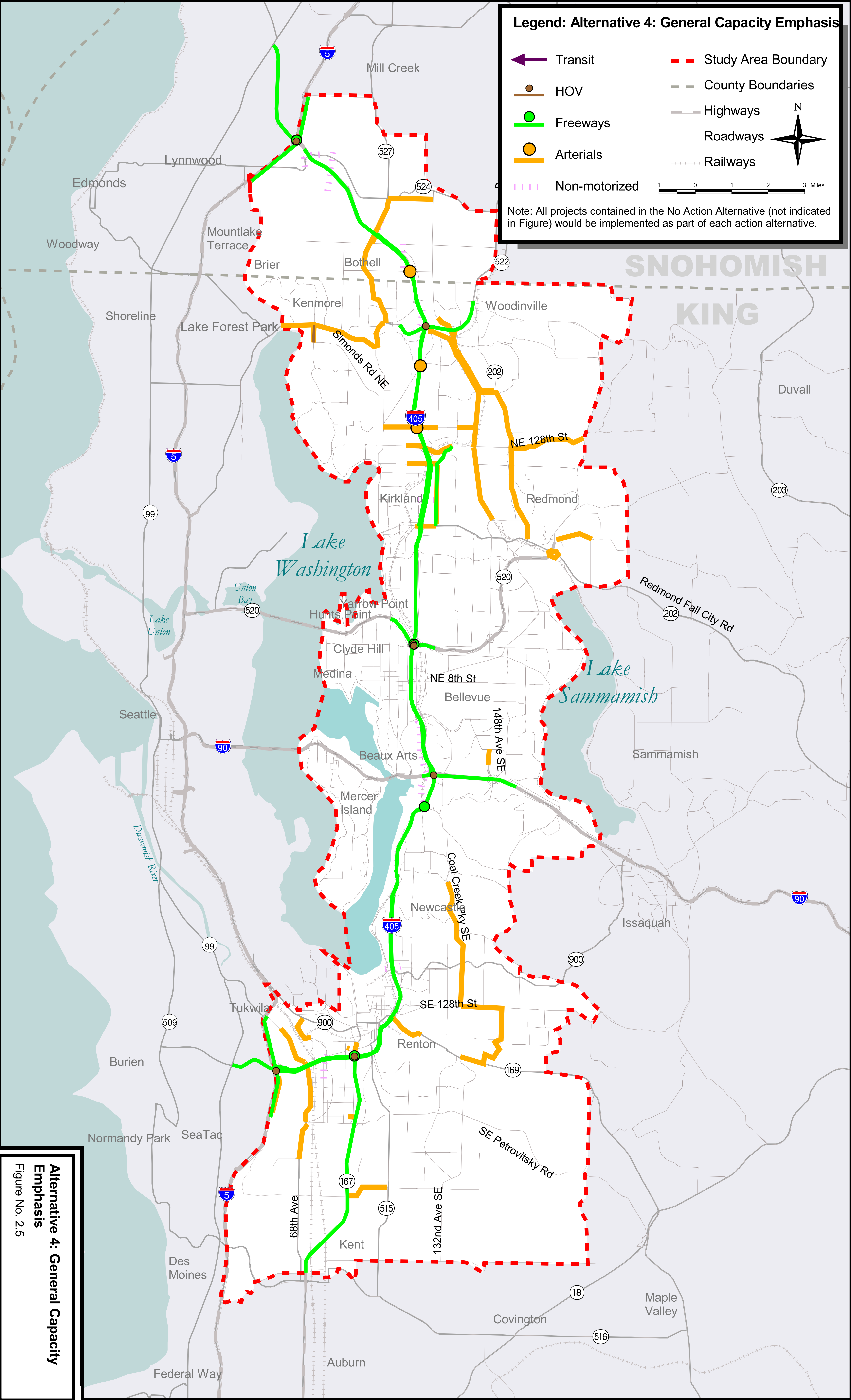

Alternative 4: General Capacity Emphasis

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2. Methodology and Coordination

2.1 EVALUATION CRITERIA

Evaluation criteria were used to measure the degree to which each Alternative meets the objectives of the project. The objectives of the I-405 Corridor Study were developed at the beginning of the project. The more than 30 agencies and jurisdictions that have the responsibility to plan for, regulate, and implement transportation improvements in the I-405 corridor extensively discussed and agreed to the following objectives for the I-405 Corridor Study:

- To find solutions that improve mobility;
- Reduce congestion;
- Improve livability;
- Improve safety for all modes;
- Are environmentally responsive, and,
- Can be implemented.

The evaluation criteria provided information to differentiate between Alternatives, and insights into the performance of each Alternative in the corridor. This information provided the decision-makers with a way to determine which of the Alternatives would perform best and meet the objectives of the corridor study.

Project committee members devoted considerable time to reviewing, discussing, and approving the evaluation criteria and performance measures. **Table 2-1** shows the relationship between the objectives of the study, the criteria, and specific performance measures for each transportation criteria.

Table 2-1: Study Objectives, Evaluation Criteria, and Transportation Performance Measures

Evaluation Criteria/Performance Measures	Definitions
A. IMPROVE MOBILITY	
Serve as much of the 2020 peak period travel demand within the corridor as possible	
Person Volumes	PM peak period person volumes by mode across 3 screenlines
	Daily person volumes by mode across 3 screenlines
Vehicle Volumes	PM peak period traffic volumes by types of vehicles (SOVs, HOVs, and trucks) at 3 screenlines
	Daily traffic volumes by types of vehicles (SOVs, HOVs, and trucks) at 3 screenlines
	Daily traffic volumes along segments of I-405
	Daily traffic volume shifts between facilities along selected screenlines
Improve predictability of travel times for all modes	
Predictability of Travel Time	Effects on travel time reliability by mode (auto, HOV, transit, freight, nonmotorized)
Provide flexibility to accommodate post 2020 travel demands	
Future Flexibility	Ability of Alternatives to accommodate post-2020 demands
Reduce travel times for all modes door-to-door compared with current conditions	
Travel time	General traffic travel times (door-to-door) between selected origins and destinations during the PM peak period
	HOV travel times (door-to-door) between selected origins and destinations during the PM peak period
	Transit travel times (door-to-door) between selected origins and destinations during the PM peak period
Reduce the share of peak period and daily trips by single-occupant vehicles	
Modal Shares	Percentage of peak period persons choosing modes of travel at 3 screenlines
	Shares of study area work trips
Transit riders	PM peak period transit riders along key segments
Transportation Demand Management	Effects on Non-HOV Trip Reduction

Evaluation Criteria/Performance Measures	Definitions
Provide effective connections to regional and local transportation systems	
Compatibility with Regional Systems	Degree of compatibility with regional transportation systems
Compatibility with local systems.	Degree of compatibility with local transportation systems
B. REDUCE CONGESTION	
Reduce congestion on study area freeways and arterials below current levels (Examine peak period and daily conditions)	
Hours of Traffic Congestion	Hours of congestion aggregated within the study area by freeway and arterial functional classification
	Hours of congestion in each segment of I-405 and arterial segments in a typical day
Vehicles Miles of Travel	Study area and region-wide daily total
Vehicle Hours of Travel	Study area and region-wide daily total
C. IMPROVE SAFETY	
Improve the safety for all modes above current levels	
Safety	Potential for traffic accident reduction along high accident locations
	System Level Effects
	Potential for improving safety for transit vehicles
	Potential for reducing conflicts between vehicles/pedestrians and bicycles

Source: Project Study Committees
Note: HOV is defined as three or more persons in a vehicle.

Methodology descriptions for several of the criteria are presented in this section. The findings from using the evaluation criteria are summarized in Chapter 4 "Impact Analysis" of this report.

2.2 CRITERIA METHODOLOGIES

■

2.2.1 Travel Forecasting Approach

The Puget Sound Regional Council (PSRC) four-county travel demand forecasting model was selected for forecasting automobile, carpool and transit demand for transportation Alternatives in the I-405 Corridor. The model was used to develop a number of different performance measures, including potentially weighted average travel times between activity centers, volume to capacity ratios at the screenline level, vehicle miles of travel (VMTs) and vehicle hours of travel (VHTs). The PSRC model is multimodal and captures both regional and corridor level trip-making.

2.2.1.1 Forecasting Sources

The I-405 Corridor Program used the current version of the PSRC model that had been modified for the Trans-Lake Washington Project (Trans-lake) Study. For Trans-Lake, refinements were made to the transit and highway networks which benefited the I-405 Corridor Program modeling effort. In addition to the refinements introduced for Trans-Lake, the volume-delay functions utilized during the peak hour periods were upgraded to the ones recently introduced by the PSRC. Once the model was validated to 1995 conditions, the model was applied to produce future year 2020 baseline forecasts as well as forecasts for the Alternatives. The baseline forecast is referred to as the "No Action" Alternative and all other Alternatives are compared against it. The "No Action" Alternative includes only those transportation improvements that have committed funding. The starting point for identifying the committed funding projects in the "No Action" Alternative was the "No Action" Alternative used in Trans-Lake. The Trans-Lake "No Action" was reviewed and refined, with additional projects from the Eastside Transportation Plan (ETP) added to the model.

The population and employment forecasts used to produce the 2020 forecasts were the "Working Forecasts" released by the PSRC in 2000 and consistent with those used for Trans-Lake. These have undergone extensive review by local jurisdictions and have been used for other transportation studies in the region at this time. The 2030 forecasts were prepared using data from the PSRC, consistent with the update of the Metropolitan Transportation Plan (PSRC 2000).

The main differences among the Alternatives were captured by changes in the highway and transit networks. The future highway and transit networks, representing each of the Alternatives, were developed using the same coding conventions as used in the 1995 network and consistent with the Trans-Lake Washington Study. The assumptions for bus and rail transit, HOV and highway speeds were based on the relative degree of grade separation from one Alternative to the next.

2.2.1.2 Unconstrained Demand Analysis

The travel-forecasting model was also used for a <u>sensitivity test</u> of "unconstrained demand" in the corridor. The purpose of the analysis of "unconstrained demand" was to give an indication as to the true demand for travel in the I-405 corridor. The hypothetical analysis helps to answer the question: *By what route would people travel within the I-405 corridor if there were no limits on available capacity or any constraints due to traffic congestion?* In other words, a condition is simulated, in which everybody travels on the shortest path (travel time wise) from their origin to destination with no resistance.

For this analysis, it was assumed that land use, population, and employment do not change in response to unlimited transportation capacity. Similarly, it was assumed that the distribution of travel, the number of trips estimated to travel between point A and point B, would not change; only the travel routes would be different

The Puget Sound Regional Model was used for a sensitivity test to estimate daily 2020 travel on the regional roadway network. The unconstrained traffic assignment differs from the constrained assignment in that it does not diminish the attractiveness of a roadway link regardless of the volumes assigned to that link. For example, in a regular multi-path, equilibrium assignment, as the volume increases on a link during iterations of the model, increasing the travel time of that link diminishes the attractiveness of that link. Subsequent model iterations then add fewer and fewer vehicles to that link until equilibrium is established within the corridor.

To run the unconstrained assignment, the travel time was held constant for all the iterations on a given link irrespective of how much volume it already carries. This gives the appearance of free flow condition on all the links. In other words, a condition is simulated, in which everybody travels on the shortest path (travel time wise) from his or her origin to destination with no resistance.

For purpose of this analysis, it was assumed that <u>land use distribution</u> is held constant within the region. Similarly, it was assumed that the <u>distribution of travel</u> within the region does not change; the number of trips estimated to travel between point A and point B would not change, only the travel routes would be different. These simplifying assumptions are reasonable given the sketch-planning nature of the analysis requested.

The unconstrained assignment loaded much more volume onto the freeways (+40 percent) and less volume on arterials and other facilities (-25 percent). The main reason for this effect is that all trips choose the shortest travel time paths and the freeways represent the shortest time path for many trips.

The results of the unconstrained analysis were documented in a working paper: *Analysis of Unconstrained Demand in I-405 Study Area, February 2000*. The unconstrained model was subsequently rerun in mid 2000 with updated model parameters from the Puget Sound Regional Council. The results were comparable with the previously documented findings.

2.2.2 Travel Time Reliability

The reliability of travel time is influenced by the system's ability to move vehicles under various conditions. When more vehicles enter into a transportation network than the capacity provides, the system becomes unstable and slowdowns occur. When a system is operating in unstable conditions, heavy rain, accidents, vehicle breakdowns and other incidents easily disrupt the flow of traffic and cause major delays. Additionally, if the system is not designed to manage such incidents with adequate shoulder widths, sight distances and other such design features, delays can become more severe. Travel times become highly unpredictable.

One effective way to measure the reliability of travel time in a highway system is to measure the average travel time and the 90 percentile travel time for fixed origin and destination trips and to compare the differences for trips throughout a 24-hour period. If the average and 90 percentile travel times are identical or very close for any given trip start time, one can conclude that the reliability of travel time is excellent. Under these conditions the great majority of vehicles are traveling at high speeds with few slowdowns. On the other hand, if the two travel times are wide apart, travelers will encounter frequent slowdowns with high levels of traffic congestion. The travel time reliability under such conditions can be stated as extremely poor.

2.2.2.1 Causes of Travel Time Fluctuations and Reliability

Transportation engineers and planners have identified several major causes for situations where travelers experience unpredictable travel times.

The major causes for creating unpredictable travel times follows.

1. Fluctuating Vehicles Volumes. Vehicle volumes in a transportation system fluctuate during the day, the week and the year. However, as long as the transportation system has enough capacity to absorb the volume fluctuations, travel times at a given moment is highly reliable. On the other hand, if peak travel demand exceeds the system's ability, or its capacity, to handle the demand, the fluctuation in vehicle volumes makes it highly difficult to predict travel time in a consistent manner.

It has been shown that when vehicle volumes reach the capacity of a network, traffic flows in the transportation system become highly unstable. When a transportation system operates in highly unstable traffic flow conditions, the reliability of travel time decreases. The severity of traffic congestion in the system is generally correlated to the travel time reliability. Typical causes of travel demand fluctuations are:

- **Increased commuter travel demands.** As the hours of traffic congestion, caused by an increase in commute travel demand, extend beyond traditional peak hours, the reliability of travel time decreases and spreads throughout the day.

- **Weekday volume fluctuations.** Daily traffic volumes fluctuate during the week. The traffic volumes on Mondays are generally higher than other days and Friday traffic volumes are usually the lowest. These variations in weekday traffic volumes may contribute slightly to the travel time reliability.

- **Seasonal volume variations.** Traffic volumes also fluctuate within a year due to changes in travel demands. During the summer months, travel demand is lower than during the winter months. The traffic volumes in the December holiday season are much higher than the peak vacation season in July and August. Travel demand in the summer months are lower, due in part to a reduction in school related trips.

- **Special events.** Surges in travel demand due to special events (sports games and major fairs) also contribute to creating unpredictable travel time situations in a transportation system.

It is important to recognize that travel forecast models used to project travel volumes assume typical weekday, peak period, or daily conditions, and do not assume the highest travel demand conditions within a year. Travel time reliability for non-SOV modes such as carpools and transit is the same as the general-purpose as long as those vehicles travel with SOVs in mixed conditions. However, when HOV modes are provided with exclusive right-of-way, they can travel in a highly reliable manner.

2. Capacity Constraints. The degree of traffic congestion, a major factor of reliable travel times, is caused by the system's capacity. There are several situations where the capacity of a transportation system is modified or reduced during a period of time. The following situations (when the system's capacity is reduced), cause traffic congestion.

- **Incidents.** Traffic incidents and vehicle breakdowns affect traffic flows. Some studies have shown that traffic incidents are one of the significant causes of traffic congestion and travel time delays in urban areas.

- **Roadway construction.** Reduced travel lanes, reduced lane and shoulder widths, placed median barriers, etc., all affect the system's ability to accommodate traffic flows.

- **Weather.** Bad weather including rain, snow, or fog, influence the capacity of a transportation system.

The temporary reductions in capacity due to incidents, weather conditions or roadway construction significantly increase traffic congestion and affect a traveler's ability to predict origin-to-destination travel times.

■

2.2.3 Flexibility to Accommodate Post 2020 Travel Demands

This criterion was measured by looking at the future flexibility of each Alternative to accommodate travel demands beyond the year 2020. It is apparent that the study area will continue to grow beyond 2020 and that travel demand will continue to increase. Growth beyond 2020 is expected to follow a trend similar to the previous 25 years, resulting in a 10-12 percent increase in regional and study area travel demand during the 2020-2030 time frame. Within the study area, daily travel on the street system would increase 5-15 percent over the 2020 conditions. Actual growth along I-405 itself would be dependent upon the amount of capacity provided to the freeway system under each build alternative.

The point of view expressed by this criterion is that it would be desirable if the corridor investments could accommodate expected transportation demands for a longer time frame than the next twenty-year period. In response, the issue was addressed from two perspectives:

- How much system capacity is remaining beyond 2020?

- Is there potential for the system to adapt to changing needs and conditions?

The first question was answered by comparing the 2020 travel demands, by mode, to the capacity provided by an alternative. Using the results of other criteria to guide this assessment a qualitative assessment was made of the remaining capacity available for growth beyond 2020. First, the screenline person demand was compared to other Alternatives and to the unconstrained forecasts. The 2020 congestion levels were then compared to current conditions (by facility type) and, the 2030 forecasts were examined to see how much additional travel demand might be accommodated by the alternative.

The second question was answered by examining the design and operational characteristics of the alternative. Certain modal designs have better flexibility to expand or to adapt to the emerging technologies that are expected during the next 20 years.

2.2.4 Transportation Demand Management

Transportation Demand Management (TDM) is a term applied to a broad range of strategies that are primarily intended to reduce and reshape the use of our transportation system to help maximize the system's effectiveness and efficiency. Some TDM strategies have been around for many years and are very simple, such as carpooling that became so important during World War II. Other TDM strategies have evolved more recently, such as vanpooling – and, even more recently, telecommuting and car-sharing. The success of many TDM strategies often depends upon the active cooperation of the private sector and the decision-making by the individuals who use the transportation system.

Both the region's Metropolitan Transportation Plan (MTP) and the state's Washington Transportation Plan (WTP) include assumptions that a substantial percent of the growth in trips in the region will be accommodated by TDM. However, funding for TDM has been nowhere near the levels that would be necessary for that to be achieved. For TDM to accomplish what the plans expect of it, it is important that significant funding for TDM be included within balanced, multimodal solution packages developed through planning efforts, such as corridor studies.

For TDM strategies to reach their maximum potential they need to be packaged into a mutually supportive program, as the TDM program proposed for Alternatives for I-405. For example, it would be pointless to market vanpooling if, at the same time, it was not assured that the operating agencies have vans available for newly formed groups. It would also be pointless to require employers to subsidize monthly transit passes if there was no bus service to the work sites.

Many TDM strategies can be clearly categorized as either "carrots" (incentives) or "sticks" (disincentives). Examples of "carrots" are vanpool fare subsidies and tax credits. Required parking charges and mandatory commute trip reduction programs are examples of "sticks". The I-405 TDM Program is built upon the assumption that more "carrots" is more acceptable and would be the most effective at reducing or reshaping use of the transportation system in the corridor.

With TDM being such a broad term, it can be difficult within efforts like corridor studies to decide what to include within the TDM program and what to include elsewhere. Bus service and improvements for pedestrians and bicyclists can be considered TDM because they provide Alternatives to driving alone. In the I-405 Corridor Study, however, they have not been included within the TDM Program. It is important to note that the I-405 TDM Program does include <u>all</u> of the marketing and promotion, communications, and educational efforts that would be aimed at encouraging travelers to use transportation modes other than driving alone. So, while within the transit component of the I-405 Corridor Program a doubling of transit service is called for, all of the marketing efforts that would deliver the new customers to that service are included within the TDM Program.

The TDM strategies included within the I-405 TDM Program are:

- ➢ Vanpooling
- ➢ Public Information, Education and Promotion
- ➢ Employer-Based Programs

- Land Use as TDM
- Pricing
- Other Miscellaneous Strategies

Appendix A includes a description of the proposed TDM program, whereas **Appendix C** gives more detailed information about each proposed TDM strategy.

2.2.5 Hours of Congestion

Measuring the "Hours of Congestion” on I-405 freeway and other freeways and arterials in the study area was used to evaluate the transportation system Alternatives. The measure examines vehicular demand on the facility throughout the day in comparison with available capacity on an hour-by-hour basis. This is done with diurnal curves.

A diurnal gives the shape of the distribution of traffic at a count point over a period of time. This is done by plotting the traffic volume over a period of 24 hours. The facility's capacity is overlaid onto the same graph to determine whether the demand at any given time is exceeding the capacity of the facility or not. Also, one can see how much capacity is left on the facility at any given time.

In general the distribution pattern or diurnal will not change dramatically in the future or at present if there is ample capacity to meet the demand on that facility. When there is not enough capacity to meet the traffic, the traffic pattern will have widened shoulders at the peak. When there is more demand for peak travel than the capacity, the excess volume will start traveling just before or after the peak, making the peak shoulders wider and wider. This phenomenon has already been observed in many places in the Puget Sound region and across the nation. The time period surrounding AM and PM peaks keep increasing, extending the peak period well beyond the traditional three hours.

The methodology used in this analysis plotted the existing traffic diurnal and capacity at a given location of the facility, and looked at available capacity. Any excess demand was distributed to both sides of the shoulder to the nearest time period where there was excess capacity. At the end of this process all the demand was met within the capacity. The hours of congestion at a specific location are calculated based on the number of hours where the demand is more than 90 percent of the capacity. This is in effect, LOS E conditions or approximately equal to 45 mph on freeways and 25 mph on arterials. By adding an hour where the speeds fall below these thresholds, the number of hours of congestion is compiled at that location over a 24-hour period.

The hours of congestion were estimated separately for I-405, and the other freeways and arterials within the study area. This was done on a link-by-link basis and then aggregated by facility classification to provide a system perspective.

2.2.6 System Level Safety Effects

The system-level safety analysis considered the following factors:

- Type of Facility- Freeway or Arterial
- Facility Design Characteristics- Proportion of facility designed to standards
- Amount of Travel measured by Vehicle Miles of Travel (VMT)
- Amount of Congestion
- Traffic Patterns

Table 2-2 summarizes the total, injury, and fatal accident rates developed for this analysis. These rates are based upon WSDOT data assembled for Puget Sound area facilities. Key variables in the accident rates are the degree to which a facility is designed 'to standards'. A standard design incorporates adequate lane widths, shoulders and stopping sight distances. Another variable is the extent of congestion. Recent research conducted for I-90 operations showed that congested freeways have higher overall accident rates than non-congested facilities. Arterial accident rates were not adjusted due to insufficient data.

Table 2-2: Accident Rate Summary for Interstates in Puget Sound

	Accident Rate	Injury Accident Rate	Fatal Accident Rate
Interstates that meet current design standards:			
Congested Interstates	**1.10**	**0.42**	**0.25**
Non-Congested Interstates	**0.64**	**0.21**	**0.45**
Non-Standard Interstates:			
Congested Interstates	**1.37**	**0.61**	**0.25**
Non-Congested Interstates	**0.80**	**0.35**	**0.45**
Arterials:			
Arterials	**3.13**	**2.10**	**1.41**

Source: WSDOT Data for Puget Sound Facilities; STEAM Model Parameters

I-405 Alternatives affect the system-level safety in the following ways:

- Making improvements to freeway geometrics that result in more of the facility designed to a 'standard'
- Changing the proportion of traffic that will operate under congested conditions (i.e. operating at speeds below 45 miles per hour on freeways; 25 mph on arterials)
- Shifting traffic from arterials to freeway facilities; Freeways have lower accident rates than arterials

2.2.7 Coordination with Agencies and Jurisdictions

The State Department of Transportation is working in partnership with the communities in the I-405 Study Area. Cities along the corridor have prepared comprehensive plans as required by the State's Growth Management Act (1990) and shaped under the adoption of Vision 2020, the Puget Sound Regional Council's (PSRC) regional growth and transportation strategy.

The I-405 Corridor Program serves as a national demonstration project for "Re-Inventing NEPA", an effort to integrate NEPA early in the transportation planning process leading to decisions that can be implemented.

As a result, throughout the project, efforts were designed into the decision-making process to continuously include all the stakeholders. At the beginning of the project, one-on-one interviews were conducted with agency and jurisdictional staff. Additionally, three committees were formed to guide the study: an executive committee comprised of elected officials; a steering committee with agency and jurisdictional staff; and a citizens committee representing other stakeholders along the corridor. A chronology compiled for the study, details the extensive project team outreach efforts. Specific meetings and discussions with regulatory agencies and jurisdictions were held throughout the study. In Summer 2000 two planning charettes were held with cities, individual meetings with city staff and agencies were held during Fall 2000. See **Appendix I**.

2.2.8 Plans, Policies, and Approvals

The I-405 freeway, the backbone of the Eastside transportation system has been studied before. The I-405 Corridor Program follows and builds upon several past planning efforts in the corridor. Likewise, the selection of the preferred Alternative will be influenced by the existing set of local and regional planning efforts.

Since the late 1980's, cities and counties in central Puget Sound have been working together to manage the region's rapid growth. This cooperative planning was advanced by the passage of the State Growth Management Act (1990) and the adoption of Vision 2020, the regional growth and transportation strategy in 1990 (amended in 1993 and 1995). These regional and local plans in the corridor include strategies to target growth within defined urban areas, creating a more compact development pattern in designated centers. As a result, to support this pattern of desired development, transportation investments are targeted to support a balanced, multimodal transportation system with an emphasis on preserving and maintaining the current network.

The final package of transportation improvements developed through the I-405 Corridor Program for the preferred Alternative will be proposed for adoption into existing local, regional, state, and federal transportation plans and programs. It is also anticipated that the corridor program recommendations will be included in the plans and programs of local jurisdictions and agencies.

Thus a number of the on-going studies, plans and projects within the I-405 study area have varying degrees of influence on the preferred Alternative selected for the corridor. Roadways within the study area are included in regional plans such as King County's Regional Arterial Network (RAN), the WSDOT State Highway System Plan (SHSP), and PSRC's Metropolitan Transportation Plan (MTP), Sound Transit's Regional Transit System Plan, and the Eastside Transportation Partnership (ETP). All of these plans have strong policy sections intended to shape transportation in the region. Most of the plans also include specific project implementation lists, usually segregated into funded and not funded categories. In addition, each of the fifteen incorporated cities in the primary study area has an urban growth area designated for urban development and concurrency requirements.

Sub-area and Corridor Studies affecting the I-405 Corridor Program study area include, East King County Corridor Study, the Trans-Lake Washington Project Study, the Fast Phase II Study of Truck Mobility (FASTrucks), Bellevue-Redmond-Overlake Transportation Study (BROTS), and the Eastside Transportation Partnership's Mobility Action Program (ETP). All of these projects are focused on a specific corridor or sub-area location. After a preferred I-405 Corridor Program Alternative is selected, each of these studies will need to be re-examined.

The following section identifies key policies in the plans adopted at regional and state levels, which would assist the decision-makers of the I-405 Corridor Program in selecting a preferred Alternative for the I-405 Corridor Program. It is not intended to list an exhaustive list of the recommendations in the study area identified in the past studies by the state and local jurisdictions.

2.2.8.1 Washington's Transportation Plan – The State Highway System Plan (1999 – 2018)

Over the last several years the Washington State Transportation Commission developed Washington's Transportation Plan (WST) The plan addresses all transportation facilities that are owned and operated by the state, including the state highway system, the Washington State Ferries, and state-owned emergency airports. Policies related to the I-405 corridor are included in the State Highway System Plan.

The first State Highway System Plan was published in January 1995. The 1997-2016 update of the Highway System Plan was issued in March 1996. The third update, the most recent State Highway System Plan (1999 – 2018) adopted in December 1997, was used for this review.

Highway Improvements

The State Highway System Plan states that improvements are needed on state-owned highways to relieve congestion, make the highways safer, support the economy and retrofit existing facilities for environmental reasons. To improve mobility within congested corridors, the Plan estimated that the State would need more than $29 billion during the next 20 years. However, only 24 percent of the costs are included in the financially constrained plan. The Plan includes high capacity transit systems, increased bus service, passenger rail, Transportation Demand Management, high occupancy vehicle (HOV) lanes, park-and-ride lots, traffic flow and access management improvements.

The Plan also states that increased capacity through the expansion of the existing system will be necessary where other modes or solutions are not viable or do not exist.

The Plan highlights the high cost of mobility improvements. It contains several strategies that are considered high cost improvements including the SR 16 Tacoma Narrows Bridge, SR 520 Bridge over Lake Washington, and I-405 Corridor improvements.

Service Objectives

The State Highway Plan adopted a set of service objectives to guide state highway investment decisions. For the Highway Mobility Program, the following objectives were adopted by the Transportation Commission:

- Complete the Freeway Core HOV Lane System in the Puget Sound Region.
- Provide uncongested (LOS C) on HOV lanes.
- Mitigate congestion on urban highways in cooperation with local and regional jurisdictions when the peak period level of service falls below LOS D.
- Provide bicycle connections along or across state highways within urban growth areas to complete local bicycle networks.

The State Highway Plan directs the state highway system in urban areas to operate LOS D or better for general-purpose traffic during the peak period. Given that many segments of I-405 would operate with different degrees of congestion within the Alternatives, it is a highly ambitious objective to achieve LOS D for the I-405 corridor during the peak periods.

2.2.8.2 Puget Sound Regional Council – 1995 Metropolitan Transportation Plan (MTP)

The Puget Sound Regional Council adopted the Metropolitan Transportation Plan (MTP) in 1995. The MTP is a long-range plan to guide transportation investments in the Central Puget Sound region. The MTP contains a series of policies that are important for the decision-makers of the I-405 Corridor Program.

The MTP includes policies to support development of dense centers and a greater mix of land uses connected by a network of transit and nonmotorized modes. It directs the region to shift emphasis from highways and single occupant vehicle (SOV) movements to transit, people and goods movements. The MTP adopted policy states that the region should: *Develop a transportation system that emphasizes accessibility, including a variety of mobility options, and enables the efficient movement of people, goods and freight, and information.*

To expand transportation capacity, the following actions are recommended:

- Development of regional transportation pricing strategies to reflect a more direct relationship between costs and benefits.
- Completions of safe and effective HOV lanes systems on freeways.
- Development of arterial HOV systems.
- Development of a regionally coordinated network of facilities for pedestrians and bicycles.
- Supporting travel demand management actions.
- Establishment of a high capacity transit system along congested corridors that connects urban centers.

With regard to the roadway expansion policy, the MTP adopted a policy that supports the development of roadways when they are needed to provide more efficient connections for a comprehensive road network to move people and goods, when such roads will not cause the region to exceed air quality standards.

The MTP lists the I-405 study as a part of its adopted program. However, it indicates that the results from the corridor study would need to be reviewed before a set of specific improvements could be adopted in a future MTP update.

2.2.8.3 Puget Sound Regional Council - Destination 2030 Regional Transportation Plan 2001 Update

The Puget Sound Regional Council (PSRC) is in the process of updating the Regional Transportation Plan. The Plan is called *Destination 2030* because it is aimed at addressing transportation needs for the central Puget Sound region for the next 30 years.

Destination 2030 assumes that the region (King, Pierce, Snohomish and Kitsap counties) will grow by 1.5 million people and 735,000 new jobs by the year 2030. To address the existing transportation problems and to accommodate the increased population and jobs, *Destination 2030* identified three test Alternatives prior to formalizing the MTP Alternatives. These test packages led to the following conclusions:

- Compact land development patterns have a significant and positive effect upon transportation system performance.
- The current level of investment in transportation projects and programs results in continued deterioration of transportation system performance.
- Significant investments in roadway expansion reduce future congestion problems, but also result in increased vehicle miles traveled, and have great difficulty in meeting air quality conformity regulations.
- Significant investments in local transit service reduce future congestion problems and help decrease the growth of vehicle miles traveled.
- Paying for transportation through user fees and charges can significantly reduce congestion on roadway facilities.

Using these conclusions, the PSRC developed three Alternatives:

- Updated 1995 Metropolitan Transportation Plan,
- Current Law Revenue, and
- Metropolitan Transportation Plan "Plus".

These Alternatives are briefly described below. It is likely that a preferred Alternative for the RTP will be a mix of transportation elements chosen from the three Alternatives.

Several of the I-405 projects in the 2001 Draft Destination 2030 EIS are included in the Updated MTP Alternative (1) and MTP Plus Alternative (3-A, 3-B). They include: one additional lane in Alt 3-B and two additional lanes in Alt 3-A from Lynnwood to Tukwila; a new intersection at 240th SE; additional HOV lanes from NE 160th St to SR 527 and Bellevue Downtown Access; new auxiliary lanes in both directions in several sections from I-90 to SR 527; and climbing lanes from SR 900 to 44th Avenue.

Alternative 1 - Updated 1995 MTP

The Updated 1995 MTP Alternative contains policies, programs and, projects from the 1995 MTP, with the addition of projects completed or underway since 1995, extended to the year 2030. The plan calls for the development of a region-wide multimodal transportation system that will link urban centers with transit-oriented investments and will serve compact communities. The system envisioned in the plan emphasizes accessibility, and includes a variety of mobility options enabling the efficient movement of people, goods, freight, and information. Increased capacity is reflected by the addition of 290 general-purpose freeway lane miles, 950 arterial lane miles, 308 freeway HOV lane miles, and 95 arterial HOV lane miles. The Updated MTP Alternative also assumes full build-out of the Sound Transit Long Range Vision Plan, with light rail extensions connecting north-south from Everett to Tacoma and east-west from Seattle to Issaquah and Redmond crossing Lake Washington on I-90.

Within King County, 40 percent of the freeway network would experience congestion (stop and go) in 2030 if this Alternative were implemented. This percentage is slightly better than the 1998 base condition, which is 43 percent. However, in Northwest King County, 37 percent of Freeway Network would have congestion (stop and go) during the afternoon rush hours.

It is estimated that $79.1 billion are needed by 2030 to fully implement this Alternative. The current revenues are projected to 2030, which resulted in $51.2 billion, which creates $27.9 billion shortfall, if no new revenues are raised.

Alternative 2- Current Law Revenue

The Current Law Revenue Alternative is limited to those elements of the 1995 MTP with committed or identified funding sources, extended to year 2030. This is the “no action: alternative. Projects, programs, and levels of service reflect revenue reductions ($ 9 billion) resulting from the Fall 1999 ballot initiative, which eliminated the state motor vehicle excise tax (MVET). Increased capacity is added to the current Metropolitan Transportation System in the form of an additional 83 freeway, 83 arterial, and 72 high occupancy vehicle (HOV) lane miles. These additional lane miles all represent a reduction from the extent of facilities planned in the Updated 1995 MTP alternative. The Alternative assumes no changes in taxes, tax rates, or the system of allocating tax revenues to various transportation uses.

If this Alternative is chosen, the levels of traffic congestion on King County’s freeways would increase: 65 percent of the freeway network congested during the afternoon commute period in 2030 from 43 percent in 1998. Nearly 82 percent of the Freeway Network in Northwest King County freeways would be experiencing congestion (stop and go) during the afternoon rush hours.

The total cost of this Alternative is estimated to be $51.2 billion, which would consume available transportation revenue during the next 30-year period.

Alternative 3- MTP Plus

The MTP Plus Alternative has been divided for technical analysis purposes into two versions: 3A focuses on improved system performance by adding roadway capacity beyond that called for in the current MTP; 3B emphasizes improved system performance through system management, transit service, and growth management provisions in addition to roadway capacity. Both represent the same Alternative of providing additional transportation capacity, but by different means.

In Alternative MTP Plus 3A the infrastructure emphasis includes all of the elements of the 1995 MTP, with the addition of projects completed or underway since 1995 extended to year 2030. In addition, increased capacity is added to the 1995 MTP in the form of an additional 392 freeway lane miles, 1146 arterial, and 157 high occupancy vehicle (HOV) lane miles. The HOV system would be completed on I-405 and SR 520. Roadway capacity is also extended through HOV system operation enhancements and improvements to the ferry system. The MTP Plus Alternative assumes full build-out of the Sound Transit Long Range Vision Plan, as was assumed in the Updated 1995 MTP Alternative.

In Alternative MTP Plus 3B increased capacity is added to the 1995 MTP in the form of an additional 52 general-purpose freeway, and 157 high occupancy vehicle (HOV) lane miles. In addition, increased capacity is added to the MTP through System Management (including Intelligent Transportation Systems and Smart Travel programs), and through transit system improvements beyond those identified in the 1995 MTP. The HOV system is completed, expanded, and operationally enhanced. Concentration of housing, population and jobs in centers, station areas and activity areas is more aggressively pursued, and market mechanisms increasingly manage parking in the most intensively developed areas.

Since this Alternative includes significant investments on the region’s freeway network, traffic congestion in the King County’s freeway network would be reduced by 2030, only 28 to 32 percent of the freeways would be congested during the afternoon commute period. Similarly, in Northwest King County, 26 to 29 percent of the Freeway Network would be congested during the afternoon commute.

The total estimated cost for this Alternative is about $99 billion. Only a half of the cost is currently available with the existing revenue sources. The shortfall would be $47 billion during the next 30-year period.

2.2.8.4 Blue Ribbon Commission on Transportation

Over two and a half years of careful study by the Governor's Blue Ribbon Commission on Transportation have culminated in 18 recommendations that call for funding a strong state and regional transportation system, emphasizing efficiency and accountability, with new strategies for financing transportation.

Of particular interest to central Puget Sound is the Commission's recommendations to empower regions within the state to "plan, select, fund, and implement ... projects identified to meet the region's transportation and land use goals." Under this recommendation, a regional authority could have responsibility to program and prioritize state and regional roadway projects within the region. The Commission's recommendations now go on to Governor Locke and the Legislature for consideration.

A Summary of Recommendations

The following is a summary of the most relevant recommendations of the Blue Ribbon Commission related to I-405 decisions, as forwarded to the Governor in November, 2000.

- Adopt transportation benchmarks as a cornerstone of government accountability at the state, city, county, and transit district levels.
- Remove the barriers to achieving the transportation benchmarks for efficiency and system performance by providing funding for a strong state and strong regional transportation system.
- Invest in maintenance, preservation and improvement of the entire transportation system so the transportation benchmarks can be achieved.
- Achieve construction and project delivery efficiencies.
- Incorporate the design-build process and its variations into construction projects to achieve the goals of time-savings and avoidance of costly change orders.
- Link transportation funding to efficiencies.
- Develop a package of new revenues to fund a comprehensive multimodal set of investments, which, taken together with the recommended efficiency measures and reforms, will ensure a 20-year program of preserving, optimizing and expanding the state"s transportation system.
- Provide regional entities the authority to raise tax and fee revenues to fund regional transportation improvements.

Begin action now to improve the transportation system.

The Commission has recommended an early action strategy that raises $8-13 billion in new state and regional funds for meeting critical transportation needs.

Transportation Revenue Recommendations

The Commission recommended that $11.545 billion in 2000 dollars be raised for the next six years for transportation investments. The recommended revenue sources for the six-year period are shown below:

Table 2-3: Blue Ribbon Commission Transportation Revenue Recommendations

Statewide Sources	2000$ Millions
Efficiency savings (10%)	214
Sales tax on the commodity price of gas (up to a set price cap)	1,100
Surcharge on transportation goods at 2%	1,266
General Fund transfer of sales tax on transportation construction	510
Flat $20 charge on passenger vehicles and non-commercial trucks	360
Subtotal all potential statewide flexible sources	3,450
Gas tax increase of around 6 cents	1,100
Gross weight fee on all vehicles	1,330
Truck surcharge (FMSIB)	150
Extend $30 license fee to all vehicles	33
Ferry fare box recovery at 80% in 6 years	95
Bonding	1,800
(Less debt service)	(271)
Total Statewide Sources	**$7,687**
Regional and Local Flexible	
Local option regional sales tax (in Puget Sound Region at 0.2%)	687
Local option VMT charge (in Puget Sound Region at 2 cents)	1,340
Local option vehicle license fee at $50 (all counties)	557
Bonding	1,500
(Less debt service)	(226)
Total Regional and Local Sources	**3,858**
TOTAL	**$11,545**

It is expected that the State Legislature will review the Commission recommendations and take some action during the 2001 session.

2.2.8.5 Sound Move – The 10-Year Regional Transit System Plan

In 1996, the residents of King, Snohomish and Pierce Counties approved the 10-Year Regional Transit Plan, called *Sound Move*. *Sound Move* implements the first phase of Sound Transit's Regional Transit Long-Range Vision. The essence of the long -range vision is to expand the capacity of region's major transportation corridors by adding a new high capacity transportation system and facilities. In addition to increasing the people-carrying capacity of the region's most heavily used transportation corridors, the system is aimed at supporting growth management policies, limiting sprawl and providing the mobility needed for a vital economy.

Three programs are included in the *Sound Move* plan to improve new facilities and services: Link Light Rail, Sounder Commuter Rail, and the Regional Express Bus/HOV System.

Link Light Rail

Link Light Rail is an electric light rail service on 23 miles of new track with 26 stations in three segments. Overall, these segments include downtown Seattle north to the University District, downtown Seattle south through southeast Seattle, Tukwila and SeaTac; and a 1.6-mile segment from downtown Tacoma to the Tacoma Dome Station. The portion called the Central Link Light Rail is approximately 21 miles of new tracks with 21 stations between Sea-Tac and the University District. The Link light rail system includes ground level, underground and elevated stations.

Sounder Commuter Rail

Sounder Commuter Rail is rush-hour passenger rail service on 82 miles of existing railroad tracks stretching the north-south length of the Sound Transit district between Everett, Seattle, Tacoma and Lakewood and includes the construction and/or improvement of 13 stations. The new stations will be located along the existing BNSF track that also serves Amtrak and Intercity rail systems. The Tukwila Commuter Rail Station will connect with the HTC system included in Alternative 2.

Regional Express Bus/HOV Systems

Regional Express Bus/HOV System will have 20 new regional bus routes operating predominantly on the state's High Occupancy Vehicle (HOV) lanes. The HOV system is designed to connect the major centers around the Puget Sound region. It includes the construction of special HOV access ramps to the freeway HOV lane network and numerous transit facilities (transit centers and park-and-ride lots). These may be new facilities or existing facilities that are a part of the state highway or local transit systems. In Alternative 3, the Bus Rapid Transit proposed will build from the service offered in the Regional Express Bus System.

Although the I-405 Corridor planning area is not directly affected by the Link Light Rail or Sounder Commuter Rail programs, Sound Transit is currently implementing the Regional Express Bus/HOV System plan within the study area. The 10-year Plan will be completed in 2006. It is not clear how the *Sound Move* plan would be implemented beyond 2006 at this time. It is possible to conceive that additional high capacity transit facilities and service would be added by Sound Transit if the voters approve additional funding in the future.

Sound Transit has plans and funding to provide three direct-access connections from the center roadway HOV lanes at Bellevue, Kirkland, and Renton.

2.2.8.6 King County Transportation Policies

In 2000, the Metropolitan King County Council adopted amendments to its comprehensive plan related to transportation policies. Listed below are several policies adopted by King County that may affect the I-405 Corridor Program:

Development of Multimodal Transportation System

King County will work with all affected parties such as state agencies, Sound Transit, local cities, citizens and businesses to develop a multimodal transportation system.

Regional Arterial Network (RAN)

In association with local jurisdictions and the state, King County will identify and develop a Regional Arterial Network (RAN) system connecting urban centers. The RAN will consist of a system of regionally significant arterial roadways that serve as major transit, freight, and/or general mobility corridors. The emphasis is on improving RAN corridors for moving people and goods. The RAN corridor improvements will be designed to relieve congestion and improve mobility and access for all modes of transportation. The RAN corridors included in the I-405 study area are: Sunset Blvd; Renton Issaquah Road; SR 900; Park Avenue SE; Maple Valley Road; Coal Creek Parkway; Factoria Blvd; Richards Road; Newport Way; 148th Avenue SE/NE; NE 8th; Bel-Red Road; Bellevue Way; Lake Washington Blvd; Market Street; 100th Ave NE; Symonds Road; 108th Ave NE; Kirkland Central Way and NE 85th Ave; 124th Ave NE; NE 124th Ave; Willows Road; SR 202; Avondale Road NE; East Lake Sammamish Way; 228th Avenue NE/SE; and Bothell Way/SR 522.

The I-405 Corridor Program arterial improvements (widening potions of roadways, improving intersections, and installing traffic control devices) are consistent with RAN's goal of improving mobility.

Transportation Pricing

King County will work with WSDOT, PSRC and local cities to develop a transportation pricing strategy that reflects the higher cost of peak hour automobile usage. This direction is also consistent with the PSRC's MTP policy.

TDM Action Strategy

King County will support development of strategies and actions to implement policies and program to reduce travel demands. The I-405 Alternatives are consistent with this approach and support Travel Demand Management strategies.

2.2.8.7 Transportation Concurrency Requirements

The Washington State legislature passed the Growth Management Act (GMA) in 1990 to encourage efficient multimodal transportation systems that are based on regional priorities and coordinated with county and city comprehensive plans. Through the GMA, local jurisdictions are required to adopt and enforce ordinances linking approval of development to maintenance of the transportation level of service standards. The ordinances must prohibit development approval if the development causes the level of service on a transportation facility to decline below the adopted standards unless transportation improvements or strategies to accommodate the impacts of development are made concurrent with the development. This provision is commonly referred to as transportation "concurrency."

The GMA clarifies that "concurrent with development" means that facility improvements or transportation management strategies to accommodate the impacts of development are in place at the time of development, or that a financial commitment is in place to complete the improvements or strategies within six years.

Most jurisdictions located in the I-405 Corridor Program study area adopted a Comprehensive Plan and a concurrency ordinance as required by the 1990 GMA.

Concurrency Ordinances Adopted by the Local Jurisdictions

The GMA allows each local jurisdiction to adopt a transportation level of service standard for its jurisdiction, based on projected growth, availability of financial resources and a degree of traffic congestion that the community can accept. The following is a list of study area jurisdictions with concurrency standards:

- Tukwila: LOS E for the commercial areas and LOS D for the residential areas.
- Renton: Total number of vehicle trips allowed per year, based upon acceptable travel time standards analyzed citywide.
- Newcastle: LOS E for the Community Business Center, LOS D for other arterial streets, and LOS C for collector and local streets.
- Bellevue: Area wide average intersection v/c ratios of 0.95 for high density commercial areas,0.90 for other commercial areas, a range of 0.80 and 0.85 for residential areas.
- Kirkland: Area wide average v/c ratios in a range of 0.92 and 1.09 for year 2001 and a range of 1.00 and 1.20 for year 2012.
- Redmond: Area wide average v/c ratios in a range of 0.85 and 0.95.
- Bothell: LOS D for most intersections. Some higher density corridors allow LOS E/F for 1.5 hours during the peak period.
- Woodinville: LOS E for all intersections.
- King County: Averaged, weighted v/c ratios of 0.69 to 1.0.
- Snohomish County: LOS E for transit compatible urban areas during pm peak two hours: LOS E for not transit compatible urban areas during pm peak one hour

Existing Concurrency Conditions

The transportation components of the Growth Management Act and its amendments seek to balance three elements: growth, level of service standards, and resources needed to improve transportation facilities. During the last several years, many of the local jurisdictions in the study area have faced situations where increased traffic congestion has threatened to exceed the agency's level of service standards. The main reason for this is that investments on transportation facilities have not kept up with increased travel demands. For example, the City of Bellevue is facing difficulties with permitting major developments in downtown Bellevue due to a concurrency problem in the East Bellevue area of the city. In Redmond, the averaged LOS has exceeded standards in a few districts. The City of Bothell is projecting that new developments planned for the next few years would violate its LOS standards in the areas close to I-405. The

City of Kirkland is planning to review the current LOS standards because of anticipated near-future LOS problems in some areas of the city.

The local jurisdiction's concurrency problems partly stem from the vehicles diverted from I-405 to the local arterials due to increasing levels of traffic congestion on that facility. As many segments of I-405 have reached its capacity to accept traffic during peak periods, the spillover effects have significantly contributed to the concurrency problems that the local jurisdictions are facing.

Effects of Alternatives on Concurrency

The local jurisdictions in the I-405 study area are facing serious concurrency problems. If those issues are not managed effectively and addressed adequately, it is possible that the projected growth might not be realized. As described below, the No Action Alternative would aggravate the existing concurrency problems. Among the built Alternatives, Alternatives 3 and 4 would do the most to help the local jurisdictions address long-term concurrency issues.

2.2.8.8 Eastside Transportation Partnership - Mobility Action Priorities

The Eastside Transportation Partnership (ETP) is a coalition of public agencies from the east side of Lake Washington working together to address transportation issues in their region. The ETP first adopted recommendations for Eastside transportation improvements in 1991. Their study concluded that no single approach to the transportation problem could be successful on the Eastside. Neither unbridled freeway expansion nor sole reliance on transit and ridesharing can be expected to accommodate the growth on the Eastside. A blend of strategies is necessary to make efficient use of limited resources. To respond to this policy approach, the following four recommendations were adopted by the ETP:

Completion of the Transportation Network

The ETP supports completion of the transportation network on the Eastside for all modes. Specifically, three policies were identified:

- Support preservation of corridors and rights-of-way.
- Support the I-405 Major Investment Study and the Trans-Lake Washington Study.

Incorporate pedestrian, bicycle and bus stop improvements into road projects.

All the I-405 Alternatives include planned and committed ETP projects. A list of the projects is provided in Appendix B (Alternatives Project Matrix).

HOV System Completion

The ETP supports completion of the HOV system, including direct access improvements. All the Alternatives support completion of the HOV system on I-405 and the completion of direct access improvements.

Improved Transit Service and Other Alternatives to SOVs

The ETP supports implementation of a multi-centered transit system that effectively serves Eastside travel, especially between and within urban centers, and provides links from the Eastside to the larger metropolitan region. Alternative 1 emphasizes reliance on HCT within the study area and significant expansion of bus transit service along with the use of TDM and regional pricing strategies. Alternatives 2 and 3 double the current King County 6-year plan, support arterial HOV priority for transit, additional park-and-ride capacity, and additional transit center capacity.

Regional High Capacity Transit

The ETP supports implementation of regional high capacity transit improvements, including *Sound Move*, and planning for Phase 2 of the Regional Transit Authority. All Alternatives support the ETP and go beyond; all assume the first phase of Sound Transit's regional plan will be implemented. Alternatives 1 and 2 include a physically-separated, fixed guideway HCT system likely using some for of rail technology and addition HCT transit center capacity. Alternative 3 includes a bus rapid transit (RPT) using the existing HOV lanes on I-405, I-90 and SR 522.

2.2.8.9 Trans-Lake Washington Project

The Trans-Lake Washington Study Committee was appointed by the Secretary of Transportation in May of 1998 to recommend a set of reasonable and feasible solutions to improve mobility across and around the north end of Lake Washington. The 47-person Study Committee represents local governments and state and regional agencies, as well as neighborhoods, businesses and advocacy interests within the Trans-Lake corridor.

The Trans-Lake Committee agreed on a problem statement and developed and evaluated Alternative mobility concepts across a full range of transportation solutions. The Study Committee is recommending an array of Trans-Lake Alternative solutions to be carried forward to a formal environmental impact study.

WSDOT and Sound Transit have moved into the environmental review phase of the Trans-Lake project. In this phase, the recommendations from the study committee, as well as Alternatives suggested by other community members, agencies, and advocacy groups, will be evaluated to determine the recommendations' efficacy in improving mobility, their impacts on the environment and affected communities, and the steps that may need to be taken to lessen or eliminate (mitigate) negative impacts or to add positive impacts (enhancements). An environmental impact statement (EIS) will be prepared as part of the review process. The environmental review process is expected to conclude in 2003.

The following is a summary of the recommendations made by the Committee in 1999.

No Single Solution; but a Set of Solutions

The Study Committee concludes that no single action, by itself, will provide an adequate response to the transportation problems. Several actions will be needed that together will provide additional capacity, improve the reliability of the transportation system, reduce demand for highway travel, and reduce impacts of transportation facilities on neighborhoods and the environment.

Recommendations for Community Enhancement and Mitigation

Mitigation and enhancement must be integral to and inseparable from the proposed transportation improvements. Mitigation and enhancement should start with sensitive project design where potential impacts are minimized wherever possible. Project design and mitigation elements should potentially include lids, multiple-level structures, grade separation, tunnels and other significant treatments such as those which have been and will be suggested by the affected communities. Mitigation of impacts caused by existing transportation facilities must be considered along with new impacts. The magnitude of mitigation measures must be commensurate with the amount of impact caused by the action.

Recommendations for SR 522

Transit lanes, signal priority, bicycle, pedestrian and safety improvements along SR 522, as called for by the SR 522 Multimodal Corridor study, and east-west connectors to and from I-5, as appropriate, should be implemented.

Recommendations for the SR 520 Corridor

Floating bridge pontoons must be replaced within their maximum remaining 25-year service life. Roadway shoulders and bicycle and pedestrian facilities should be considered as part of any new or replaced bridge crossing.

- The EIS should evaluate the following combinations of additional transportation elements in each direction on SR 520:
- One HOV lane in each direction
- One HOV lane in each direction and high-capacity transit
- One HOV lane in each direction and one general-purpose lane in each direction
- One HOV lane in each direction, high-capacity transit, and one general-purpose lane in each direction

These combinations should be evaluated along with a No Action and a Minimum Footprint alternative. The Minimum Footprint Alternative would include maintaining the existing four lanes while improving transit and HOV access to SR 520, bicycle/pedestrian access, and providing for a median barrier and minimum roadway shoulders while maintaining a minimal footprint.

Recommendations for the I-90 Corridor

There should be continued study of Sound Transit's proposal to establish 2-way HOV/transit operation on I-90. I-90 should remain convertible to include high-capacity transit in the future.

Recommendations for High-Capacity Transit

Preference should be placed on high-capacity transit in the SR 520 corridor. In the event that technical constraints limit consideration of high-capacity transit as an integral SR 520 structural component, other alignments, including an exclusive right of way for high-capacity transit, should be considered. Provision of high-capacity transit will not eliminate the need for other Trans-Lake improvements, and implementation of high-capacity transit should not result in reduced Trans-Lake HOV capacity overall.

Recommendations for Transportation Demand Management (TDM)

A strong TDM program should be supported in the Trans-Lake Corridor. Implementation of single occupant vehicle (SOV) trip reduction goals will be supported by an interlocal or subregional agreement.

Relationship with I-405 Corridor Program

The I-405 Corridor Study is coordinating with Trans-Lake Study including the following two issues:

- HCT across Lake Washington;
- SR 520 design connections with I-405; and
- Area-wide Transportation Demand Management (TDM) program.

2.2.8.10 Bel-Red Overlake Transportation Study

On a more sub-regional focus, there is the first BROTS study, which was completed in 1986 and was adopted by both Bellevue and Redmond in 1988. The study represented a joint effort by the cities, as well as the Washington State Department of Transportation and Metro Transit. Its goal was to develop coordinated transportation solutions, which would meet the needs of both cities. The study addressed a number of issues, including traffic growth within and surrounding the Overlake area; the area's emergence as a significant employment center; the potential for transit, carpools, and vanpools to reduce traffic congestion; and adding freeway lanes versus widening arterials.

In contrast with the first study, the BROTS Update has examined a broad array of transportation issues. These have included evaluating multimodal transportation needs into the year 2010, reassessing the planned transportation improvements included in the original study, and focusing on how a combination of roadways, public transit and nonmotorized travel can enhance mobility.

The related elements of the agreement which would be supported by the I-405 project are:

- Land use. Based on each cities' adopted land use plans, the agreement limits Overlake-area land use in Redmond to 15.4 million square feet and in Bellevue to 12.2 million square feet. (Current development in Redmond is 13 million square feet, Bellevue development is 10 million square feet.)
- Transportation. The plan details 45 transportation projects in Redmond and Bellevue costing $69 million. The projects range from adding lanes in commercial areas, adding turn lanes, and improving intersections.
- Regional coordination. The two cities will collaborate to:
    - Build regional support for expanded capacity on State Route 520 and Interstate 405;

- Work with Sound Transit on high capacity transit and
- Obtain state and federal funding for transit, roads and other services addressed by the agreement.

2.2.8.11 Trans-Valley Corridor Study

The study will complete the pre-design and engineering of intersection and arterial improvements and identify future transportation needs for this cross-valley corridor in the rapidly growing section of South King County including Renton, Tukwila, SeaTac and Kent. The goals of the study are to coordinate all existing transportation plans, generate options to address the problems including congestion, capital improvement projects for general traffic and HOVs, transit facilities and service improvements, and improvements for freight traffic.

Relationship to I-405

- Connections to SR 167 for general traffic and HOV access
- Regional coordination for TDM strategies

2.2.8.12 Freight Action Strategy for Seattle – Tacoma (FAST)

WSDOT is working with the Puget Sound Regional Council (PSRC), the region's metropolitan planning organization, to define freight mobility needs through the "Freight Action Strategy for Seattle-Tacoma" (FAST) planning effort.

The FAST project is focused on north-south travel between Everett and Tacoma and east-west movement between the ports and the warehousing and industrial areas they serve, as well as interregional freight movements. The FAST effort includes segments of Interstate 5 in the Puget Sound region and the rail corridor within its scope. FAST operates collaboratively, with representatives from the member agencies, both public and private, determining policies. In Phase I, FAST has identified a series of 15 highway/rail grade separations and port access projects, from Everett to Tacoma, ready for implementation in the near term. Several of these are beginning construction this year in Tacoma, Auburn and Pierce County: respectively, grade separations at the SR 509/Port of Tacoma road intersection; at 3rd Street SW in Auburn, and at Eighth Street E. in Pierce County.

Phase II FAST is providing examination of freight mobility issues in the region. In Phase II, FAST is examining location-specific capital and operational improvements -- such as dedicated regional freight capacity -- for inclusion in regional and state transportation plans. It is also incorporating additional grade separation projects for inclusion in freight mobility program proposals being developed at the state level.

2.2.8.13 Corridor Needs Study for East King County (CONEKC)

The CONEKC Study was conducted at the request of the Washington State Legislature because of increasing highway congestion in the central Puget Sound region. This study was structured as a need assessment and "what if" technical study to better understand current and year 2020 travel needs for north-south trips. The study area included the central Puget Sound area focused on south Snohomish County, King County and north Pierce County and the local impact area was defined in east King County, between Lake Sammamish and the Cascade Mountains.

The study evaluated three scenarios: 1) north-south freeway, 2) arterial parkway system, and 3) major transit/arterial investments. The assumptions and findings for each Alternative are summarized below:

North-South Freeway Scenario

A new freeway runs on SR 18 and parts of US-2 alignments. Parts of SR-203 serve as frontage road. Limited interchanges are located to serve only the urban growth areas. The freeway would be located in the areas outside the urban growth areas.

Key findings:

- ➢ The new freeway would carry 62,000 daily trips.
- ➢ Vehicle Miles Traveled (VMT) would increase by 27 percent.
- ➢ Traffic volumes would be reduced on all major north-south facilities with I-5 receiving the most benefit.

Travel time savings during peak periods would be between 20 and 30 minutes for north-south direction travelers.

Arterial Parkway System Scenario

This Alternative identified three possible north-south parkway alignments. Some east-west arterials would be widened to improve system continuity. The capacity of the park way system is about the same as the freeway scenario. The parkway would be located in both outside and inside of the urban growth boundaries.

Key findings:

- ➢ VMT increases by 14 percent
- ➢ Adds capacity to local impact area with less regional traffic shifts from the existing freeways
- ➢ Travel time savings would be in a range of plus and minus 10 minutes.

Major Transit/Arterial Investment Scenario

This Alternative assumes that aggressive investments in transit would be overlaid on the Arterial Parkway System scenario.

Key findings:

- ➢ Congestion and mobility benefits are the same as those found in the Arterial Parkway scenario.
- ➢ The number of daily transit riders would increase by 4,100 in the I-405 and east King County study areas.

The study did not select a preferred Alternative and specific facility improvements in the east King County area. However, the summary report stated that no action would result in increased congestion with impacts on our economy and quality of life. This study process is continuing to find a right balance among community goals and desires, environmental impacts, travel needs and public interests.

Relationship with I-405 Corridor Program

The Executive and Steering Committees for the I-405 Corridor Program reached consensus that the arterials and freeway Alternatives studied in the CONEKC study should not be included in the I-405 Corridor Program with the following reasons:

- The arterials and freeway improvements are located outside the primary study area of the I-405 Corridor Program.
- The CONEKC scenarios do not directly address the purpose and need statement of the I-405 Corridor Program.
- The freeway scenario has significant environmental and growth management issues.
- The facility improvements in the CONEKC study affect areas outside the I-405 Corridor program study area, and would impact the decision-making process of the Corridor Program.

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2.2.9 Framework for Cumulative Effects Analyses

The 2001 update of the Metropolitan Transportation Plan (MTP), referred to as *Destination 2030*, includes many of the transit, freeway, and arterial improvements contained in the I-405 Corridor Program action Alternatives. The environmental effects of these I-405 corridor improvements and all other proposed transportation investments in the region were reviewed at a programmatic level in the *Final EIS for Destination 2030, The Metropolitan Transportation Plan for the Central Puget Sound Region* (Puget Sound Regional Council, May 2001), which is incorporated here by reference. The potential cumulative effects of these improvements are re-evaluated here in slightly different combinations than in *Destination 2030* (as the I-405 Corridor Program action Alternatives), and they are combined with some transportation improvements that were not included in *Destination 2030*. Nonetheless, the *Final EIS for Destination 2030* provides a useful point of reference for assessing the magnitude and significance of the I-405 Corridor Program Alternatives.

The Puget Sound Regional Council (PSRC) 20-year projections of growth in households and employment within the central Puget Sound region provided a partial basis for evaluating the geographic distribution of potential cumulative effects on critical resources, ecosystems, and human communities. In order to accomplish this, the PSRC land use forecasting model (DRAM/EMPAL) was used because the study area is located within the four counties covered by the PSRC. This is the same forecasting model used by the PSRC to develop and update the MTP. For the I-405 Corridor Program forecasts and analyses, the proposed transportation improvements contained within each Alternative were entered into the DRAM/EMPAL model in the form of increased access and mobility. King County, Snohomish County, and the PSRC also were consulted in order to gain an understanding of issues related to model outputs.

2.2.9.1 Relationship to Metropolitan Transportation Plan and Other Regional Actions

2.2.9.1.1 Metropolitan Transportation Plan

Destination 2030 is the 2001 update of the 1995 Metropolitan Transportation Plan (MTP). *Destination 2030,* operating as the transportation element of VISION 2020, emphasizes an integrated multi-modal transportation system and describes the regionally significant modal components of that system. The MTP serves as a planning tool used to identify regional transportation problems and analyze and develop regional solutions, and it serves as a focus for required state and regional transportation system performance monitoring, particularly for the federally mandated congestion management system.

Destination 2030 supports a balanced multi-modal transportation system that provides options to users, but the plan recognizes that capacity enhancements are needed to improve mobility on the region's roadways. Under *Destination 2030* vehicle miles traveled (VMT) is expected to increase by 45 percent and population by 50 percent over the next 30 years. To address this growth, the plan calls for an aggressive program of transportation investments. With these investments, the growth in travel demand can be accommodated with relatively minor impacts on system performance, such as a 2 percent increase in congestion (PM peak) in 2030.

The Metropolitan Transportation System (MTS), which is the system component of *Destination 2030,* includes the following major elements:

Roadways. The roadway and high-occupancy vehicle (HOV) systems are integral components of the region's transportation system and will continue to be into the foreseeable future. Individual streets and roads do not function independently, but rather form a network through which traffic flows and connects to regional freeways. *Destination 2030* includes improvements on principal arterials and arterial HOV lanes, and adds general-purpose and HOV lane miles to the interstate and state route system in the four-county region.

Transit. The transit component is comprised of major regional transit services and facilities that provide public transportation access between major regional activities centers, connecting designated urban centers and major regional employment locations. Regional transit services can provide an alternate travel mode in congested corridors. In addition to the region's planned fixed-guideway HCT (light rail and commuter rail) and passenger-only ferry service, transit services are also represented by the transportation facilities they use – general-purpose lanes, HOV lanes, and exclusive transit rights-of-way. Regional transit facilities include major park-and-ride lots, transit centers, and ferry terminals.

Non-Motorized Transportation System. This component of the MTS includes pedestrian improvement zones located in designated urban centers and regional transit station areas including bus, rail, and ferry facilities.

I-405 Corridor Program Improvements Contained in Destination 2030

All of the core projects and strategies in the four action Alternatives developed for the I-405 Corridor Program are included in *Destination 2030*. These transportation improvement projects and strategies are in response to the planned growth under the existing jurisdictional comprehensive plans, which in turn conform to the regional planned growth under *VISION 2020*. *Destination 2030* includes the I-405 study arterial, transit, and freeway improvements, and includes two general-purpose lanes in each direction on I-405. These additional lanes are included in Alternative 3.

The I-405 Corridor Program Alternatives do not include all the HCT facilities that are included in *Destination 2030*. Links completing the HCT network around the region, such as north to Everett by 2030, are not included. Alternatives 1 and 2 do include the following fixed-guideway HCT routes and stations: Seattle to Issaquah across Mercer Island / I-90; SeaTac to Totem Lake in the I-405 corridor; and Bellevue to Redmond. In addition, the MTP uses HOV 2+, while the I-405 Corridor Program study uses HOV 3+ in the Alternatives. Analysis showed that the HOV use along I-405 does not vary much among the study Alternatives since the number of HOV lanes remains constant across Alternatives. HOV 3+ use ranges from 3 to 4 percent of vehicles in the north end, and up to 10 percent in the south end of the corridor.

Appendix B identifies the projects within each Alternative for the I-405 Corridor Program. The lists of projects included in the *Destination 2030* are found in Appendix 9 – Project List and the Supplemental Destination 2030 Project List of *Destination 2030*.

In addition, reasonably foreseeable federal, non-federal, and private actions identified during scoping that could be cumulative with the I-405 Corridor Program action Alternatives are already addressed within the *Final EIS for Destination 2030* (May 2001). The most notable among these are the following, which are discussed in greater detail below:

- Trans-Lake Washington Project
- I-90 HOV transit improvements and lane additions between I-5 and I-405
- Sound Transit Phase II
- VISION 2020 proposed long-term regional land use plan

2.2.9.1.2 Trans-Lake Washington Project

WSDOT and Sound Transit have moved into the environmental analysis, documentation, and review phase of the Trans-Lake project to study options for crossing Lake Washington north of I-90, including the SR 520 Bridge. In this phase, the recommendations from the study committee, as well as Alternatives suggested by other community members, agencies, and advocacy groups, will be evaluated to determine the recommendations' value in improving mobility, their impacts on the environment and affected communities, and the steps that may need to be taken to avoid or mitigate negative impacts or to add positive impacts. An EIS will be prepared as part of the review process. The environmental analysis, documentation, and review process is expected to conclude in 2003. HCT across Lake Washington north of I-90 is not included in the I-405 Corridor Program or *Destination 2030*; the HCT is on the I-90 facility from the I-405 Interchange to downtown Seattle in Alternatives 1 and 2.

I-90 Transit Improvements and Lane Additions

HCT is assumed to operate along I-90 from Seattle to Issaquah by 2020 in Alternatives 1 and 2, and in *Destination 2030*. A Sound Transit study is currently looking at ways to improve transit on the I-90 bridge. It is not clear at this point if I-90 will convert the reversible express lanes to two-way transit operation, or whether they will remain as reversible lanes.

2.2.9.1.3 Sound Transit Phase II

Since 1996, Sound Transit has been implementing Sound Move, the first phase of the voter approved regional transit long-range vision that includes regional bus service, HOV access improvements, park-and-ride lots, and commuter rail and light rail. Except for commuter and light rail facilities, a variety of these regional HCT investments are being implemented along the I-405 corridor. At the present time all of the Sound Move commitments programmed for the I-405 corridor should be completed by 2006, the original completion year for Phase I. All Sound Move commitments are included in *Destination 2030* and the I-405 Corridor Program Alternatives.

The Sound Transit Board is now considering substantial changes to routes and segment phasing for LINK light rail in Seattle, which would extend the first phase Sound Move implementation period for that element alone out to approximately 2009. Sound Transit has targeted 2004 as the probable year for a Phase II public vote on a new set of proposed regional HCT investments to be implemented between 2006 and 2016 or 2020. Assuming a positive vote outcome, the plan would provide additional (but as yet unspecified) HCT facilities and services to east King County, including jurisdictions within the I-405 corridor.

In the I-405 Corridor Program Alternatives 1 and 2, HCT was assumed to operate as a center-to-center fixed-guideway system utilizing BNSF and I-405 right-of-way along the length of I-405, with extensions to Redmond via SR 520 and to Issaquah via I-90 corridor alignments. Alternative 3 assumes that the high-capacity transit element would take the form of an advanced bus rapid transit system, primarily using HOV lanes, operating on I-405, SR 520, and I-90.

2.2.9.1.4 VISION 2020

Destination 2030 functions as the transportation element of *VISION 2020*. *VISION 2020* describes a regional land use pattern consistent with and supportive of the state's GMA policies (Growth Management Act). *Destination 2030* provides the regional transportation system to support the planned growth. The local comprehensive plans for cities in the study area were developed within the framework of *VISION 2020*. The Alternatives for the I-405 study are consistent with all local jurisdictions' adopted land use zoning. The I-405 Corridor Program action Alternatives are consistent with GMA in that they support implementation of the envisioned regional land use pattern.

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3. The Affected Environment

This chapter summarizes transportation facilities and travel conditions in the I-405 corridor. A discussion of various travel modes in the study area, including transit, nonmotorized facilities, and freight usage, follows the description of general roadway characteristics. In addition, recent data profiles traffic conditions along the corridor, including daily volumes, personal carried per day, and average vehicle occupancy and accident history. More detail is provided in the *I-405 Existing Conditions Report* and *Background Report* issued in 1999. The chapter closes with a brief overview of transportation demand management programs active in the corridor.

3.1 ROADWAY NETWORK

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3.1.1 I-405 Facility

The roadway network within the I-405 study area reflects local geography and the development patterns that have occurred over the years. The relatively sparse roadway network in the I-405 study area creates the demand for the higher capacity state highways (e.g. I-405, I-90, SR 520, SR 522) to frequently serve as the principal means of transportation, even for non-regional trips. Other major arterials also become heavily congested as the area's population and employment grows.

Interstate 405 is the transportation backbone of the primary study area, beginning at I-5 in Tukwila and ending in the north at 1-5 outside Lynnwood. It is the designated military route through Seattle, with Interstate 5 having been deemed too constricted. Interstate 405 varies from six to ten lanes along the 30-mile corridor. The section of I-405 from I-5 in Tukwila to I-90 includes two general-purpose lanes and an HOV lane in each direction with 4 to 10 feet shoulders. The next section from I-90 to SR 522 in Bothell is provided with three general-purpose lanes and an HOV lane in each direction except for the northbound direction between SR 520 and NE 70th where it has one additional auxiliary. On the section north of SR 522, I-405 has two general-purpose lanes in each direction. An HOV lane in each direction, between SR 522 and SR 527 in North Bothell, are due for completion in summer, 1999. HOV lanes between SR 527 and I-5 in Lynnwood will be constructed over the next four years.

There are 25 interchanges on I-405 including the connections with I-5. Sound Transit has plans to provide six direct-access connections from the center roadway HOV lanes in Bellevue, Kirkland, and Renton.

3.1.2 Supporting Roadway Network Characteristics

The roadway network supporting I-405 consists of freeways and surface streets intersecting with or paralleling I-405. A total of nine state highways connect with I-405 along its length: SR 167, SR 169, SR 181, SR 900 (Sunset and Park interchanges), I-90, SR 520, SR 908, SR 522, and SR 527. At the north end of the study area, I-405 becomes SR 525 in Lynnwood, while at the south end SR 518 is the extension heading west towards SeaTac and Burien. Two other state highways (SR 515 and SR 524) cross but do not connect with I-405. Another highway in the primary study area, SR 202, parallels I-405 between SR 520 and SR 522. Major local arterials include: Woodinville-Duvall Road, Bellevue–Redmond Road, Petrovitsky Road, Richards Road, 148th Ave NE, and Coal Creek Parkway.

3.2 TRAVEL MARKETS

Travel markets are characterized by such trip attributes as length, purpose, and patterns. Overall, travel demand is the I-405 corridor is expected to generally follow the region's trend of a greater than 50 percent increase in person trips between 1995 and 2020. The following sections summarize these characteristics.

3.2.1 Trip Purpose

Trip purpose is an important factor in understanding travel markets to be served. Some trips are more easily accommodated by Alternative modes than others, so in order to fully explore travel demand by all modes it is important to understand what kind of trips are expected within the study corridor. Generally, work trips provide greater opportunity for HOV/transit Alternatives, as their demand is more predictable (typically during the peak periods). Congestion is usually at its highest during the peak periods, so HOV/transit facilities provide the maximum travel time savings during this period, thus making them more attractive to potential riders.

Today in the study area, approximately 20 percent of the total daily person trips are home-based work trips while 39 percent of daily person trips are home-based other (e.g., shopping, recreational, personal business) and 28 percent are non-home based (e.g., traveling from work to daycare or shopping). School (2 percent) and commercial vehicle trips (11 percent) make up the rest. The relative shares of each trip purpose are expected to be similar in 2020. The fairly small share of trips, which are purely home-to-work or work-to-home reflects the fact that people are increasingly linking their trips, stopping on the way home to shop, pick up children, etc. (which are considered non-home based trips).

Currently at the regional level, the percentages are similar to those for the study area, but with a somewhat larger share of home-based other trips (43 percent). Only minor changes are forecast for the year 2020 at the regional level with both home-based work and non-home based expected to increase one percent and home-based other to decrease two percent.

3.2.2 Trip Distribution

Trip distribution examines where trips are going and coming from in relation to the study area. The analysis focused on three trip categories in the I-405 corridor: 1) trips that begin and end in the corridor; 2) trips that either begin or end in the corridor; and 3) trips that begin and end outside of the study area, and in particular through trips.

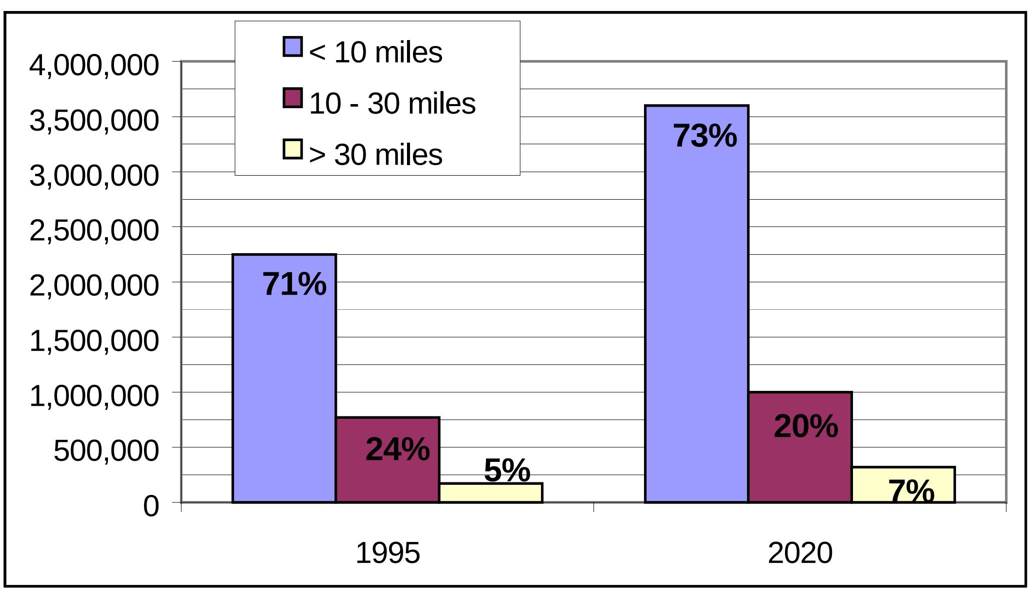
Currently, just under 55 percent (1,740,000) daily trips begin and end within the study area. Another 45 percent (1,430,000) trips have only one trip end in the study area Forecasts for the year 2020 show very little change in the percentage of daily person trips in the two categories.

3.2.3 Trip Length

Trip length is also an indicator of trip distribution. As shown in **Figure 3-1**, over 70 percent of total daily persons make trips of less than 10 miles within the study area; conversely, less than 10 percent of trips are over 30 miles in length. The average trip length is around 9 miles. This trend is expected to remain fairly steady over the next 20 years; average trip lengths are expected to increase to around 10 miles.

I-405 carries a higher proportion of longer trips, compared to the study area average. This is due to the fact that longer trips tend to focus on major facilities, while shorter trips are predominant on local streets and arterials. Along several sections of I-405, the average vehicle trip length exceeds 25 miles, roughly three times the study area average. Forecasts for 2020 show the freeway to attract even more long trips, with over 50 percent of all trips on I-405 exceeding 30 miles in length. Figure 3-1 shows trip lengths for the year 1995 and 2020.

Figure 3-1: Trip Lengths in the I-405 Corridor



Source: Puget Sound Regional Council

3.3 MODE SPLIT

Mode split refers to the modes, or methods of travel that we use to work, shop, or play. Mode usage varies by the time of day, purpose of the trip, and specific facilities being analyzed.

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3.3.1 Daily Mode Splits

Table 3-1 summarizes the mode split for all daily person trips within King County.

Table 3-1: King County Daily Person Trips (1997)

Type of Travel	All Trips Mode Split	Work Trips Mode Split
Single Occupant Vehicle	56%	73%
High Occupancy Vehicle (2+)	34%	13%
Transit	4%	6%
Walk	5%	6%
Bike	<1%	1%
Other	<1%	2%
Total	**100%**	**100%**

Source: PSRC Surveys 1994-1997

The same surveys showed different results for daily work trips in King County. The single occupant vehicle (SOV) share is much higher (73 percent), HOV is lower (13 percent), transit is higher (6 percent), and other modes are about the same.

The mode split for the I-405 study area portrays a different picture. Census data (1990) indicates that the SOV usage for work trips is up to 5 percent higher in the I-405 study area than the county average, while HOV and walk/bike percentages are lower. These results reflect the more suburban character of the I-405 study area.

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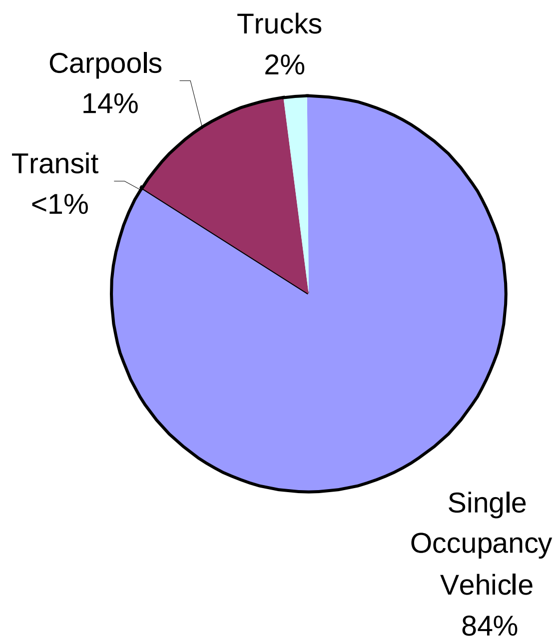
3.3.2 Peak Hour Mode Splits

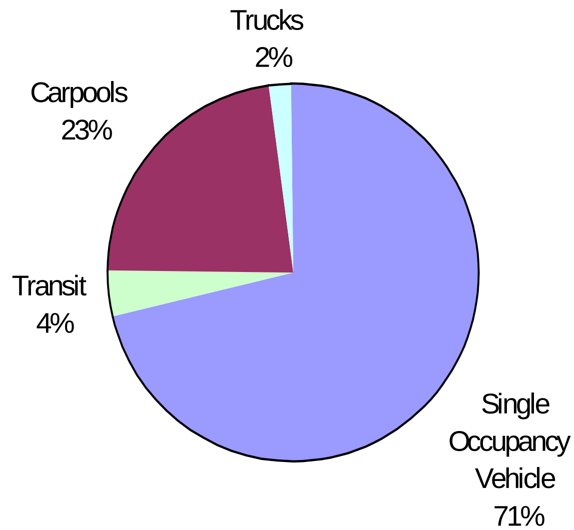
Figures 3-2 and **3-3** show the existing (1998) vehicle and person mode splits for the PM peak hour along I-405 itself, in the vicinity of downtown Kirkland. Single occupant vehicles comprise 84 percent of all vehicles at this location, buses and carpools (2+) constitute 14 percent, and trucks account for around 4 percent. The truck percentage observed is higher in other parts of I-405 corridor. Observed buses and carpools (considered "High Occupancy Vehicles" or "HOVs") carry 27 percent of all people who travel in that section of I-405 during the peak hour. I-405 carries a higher proportion of transit and carpool trips due to tits regional focus and presence of HOV lanes along its length.

Figure 3-2: Vehicle Mode Split for I-405 (PM Peak Hour at NE 85th Street)



Source: WSDOT

Figure 3-3: Person Mode Split for I-405 (PM Peak Hour at NE 85th Street)



Source: WSDOT

3.4 TRAFFIC

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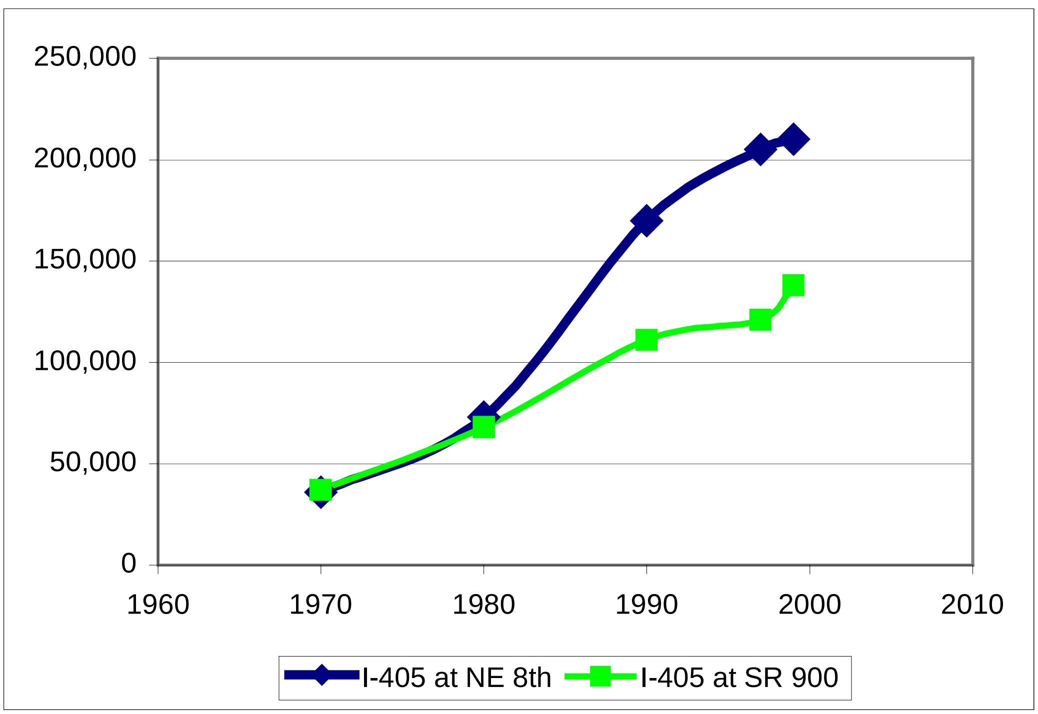
3.4.1 Traffic Growth on I-405

In 1970, I-405 carried 20,000 to 40,000 vehicles per day. While the entire corridor experienced a 400 percent increase in traffic volume from 1970 to 1996, various sections of I-405 show different rates of traffic growth. For example, in 1996, I-405 carried approximately 95,000 vehicles per day in the section from SR 522 north to Swamp Creek, compared to 170,000 in the section between I-90 and SR 520.

Figure 3-4 illustrates historical traffic growth, using two points on I-405: NE 8th Street in Bellevue, and SR 900 in Renton. The section of I-405 in the vicinity of NE 8th Street in Bellevue in 1999 carried about 210,000 vehicles per day, which was recorded as the highest volumes in the corridor. I-405 at SR 900 carried about 138,000 vehicles per day, which is the typical level of traffic volumes in the roadway sections south of I-90.

Figure 3-4: I-405 Traffic Growth



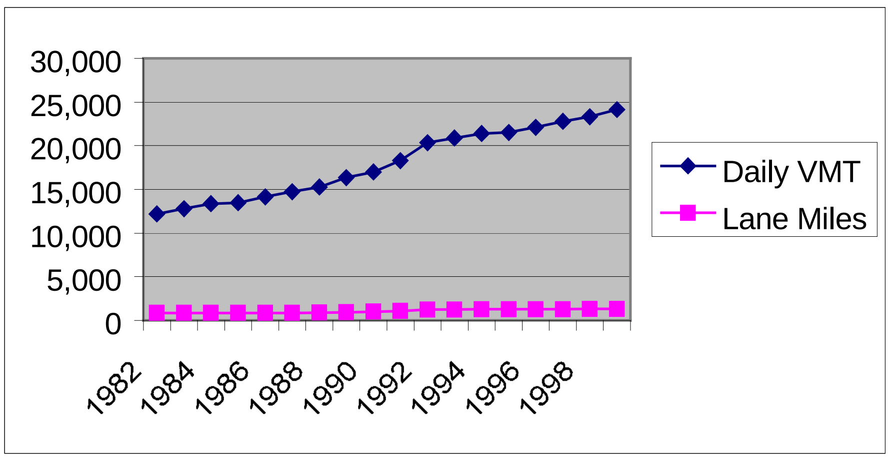
Source: WSDOT

3.4.2 A Historical and Regional Perspective

The I-405 corridor is one of many transportation corridors within the regional network of roadways connecting communities throughout the Puget Sound. The four-county region has more than 11,400 lane miles. The I-405 corridor study area has about 13 percent of the region's roadways. Because of the relatively sparse roadway network in the I-405 study area (about 1,500 lane-miles in the 250-square-mile area), there is greater reliance on state highways to serve non-regional trips than would normally be the case. Interstate 405 is the transportation backbone of the study area, and travel demand within the study area is heaviest on I-405 itself.

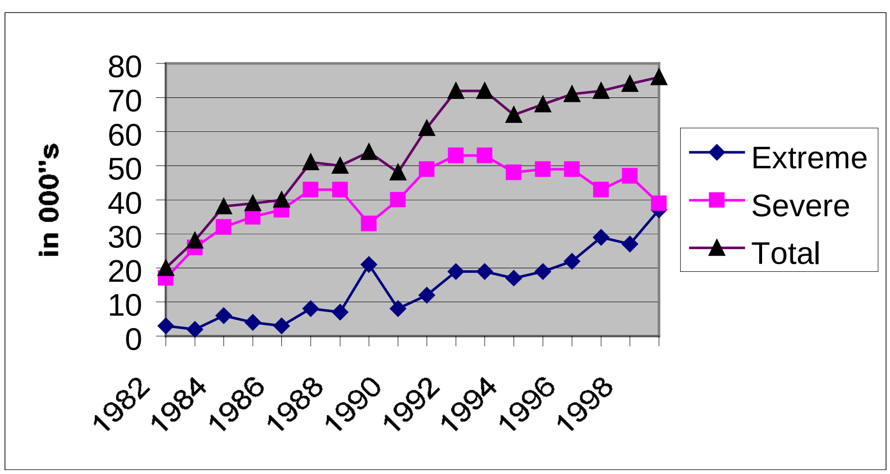
Figure 3-5 shows the growth of freeway lane miles and daily VMT in the region over the past 20 years. **Figure 3-6** shows the result, increasing percentage of lanes with peak period congestion. Extreme congestion continues to increase each year, as the freeways have become more crowded during the peak hours.

Figure 3-5: Growth in Freeway Region-wide Daily VMT (000's) and Freeway Lane Miles 1982-2000



Source: Texas Institute Mobility Data for Seattle-Everett, 2001 Urban Mobility Study

Figure 3-6: Percent of Peak Period Travel in Severe or Extreme Congestion (1982-2000)



Source: Texas Institute Mobility Data for Seattle-Everett, 2001 Urban Mobility Study

In evaluating the regional cumulative effects of the I-405 Corridor Program, the forecasts for population, employment, and travel demand in the corridor were compared to forecasts for the four-county central Puget Sound region. Several observations were made. As the Eastside has grown, traffic volumes have increased dramatically. From 1970 to 1999, the average daily traffic on I-405 north of I-90 increased nearly five-fold, growing from 41,000 to 198,000 cars per day. The roadway network has not expanded at the same rate, resulting in increased congestion on all the roads, especially on the I-405 freeway.

While the entire corridor experienced almost a 400 percent increase in traffic volumes from 1970-1999, various sections of I-405 show different rates of traffic growth. From 1980 to 2000, the increase in the corridor was 150 percent, as capacity was reached on several sections of I-405. **Table 3-2** presents a historical summary of the average annual daily traffic on selected arterials and state roads in the I-405 Corridor Program study area.

Table 3-2: Average Annual Daily Traffic on Selected Arterial and State Roads in I-405 Study Area (1965 to 1999)

Measurement Location	1965	1970	1975	1980	1985	1990	1995 baseline	1999
I-405 north of I-90	24,400a	41,000a	53,400a	80,100a	115,400a	137,600c	164,832	198,000c
I-405 north of SR 520	12,100a	33,400a	48,400a	76,400a	107,400a	146,800c	152,174	178,000c
I-405 north of SR 522	N/A	15,000a	20,300a	37,200a	52,700a	88,400c	92,822	94,000c
I-405 south of I-90	24,000	N/A	N/A	76,000c	115,400c	129000	116,525	168,000c
SR 522 west of I-405	N/A	N/A	N/A	21,500c	24,800c	30000	32,000c	38,000c
SR 908 east of I-405 (Rose Hill)	N/A	N/A	N/A	24,800c	28,300c	30000	31,000c	46,300d
148th Ave SE north I-90	N/A	15,000a	18,400a	22,600a	30,200a	N/A	N/A	39,700e
Lake Wa Blvd north of SR 520	2,200a	11,800a	11,700a	23,000a	27,500a	N/A	N/A	N/A
I-90 Mercer Island Bridge	17,900 b 42,892a	48,352a	48,655a	52,283a	68,500a	112,400c	128,000c	121,000c
SR 520 Lake Wash. Bridge	22,998a	37,744a	47,544a	72,130a	99,500a	97,700c	100,000c	110,000c

a Eastside Transportation Program, Background Report, October 1988, p. 4.
b Number of vehicles in 1961, Puget Sound Regional Transportation Study
c WSDOT Annual Traffic Report, 1983, 1985, 1991, 1994, 1996
d City of Kirkland, 1999 traffic counts
e City of Bellevue , 2000 traffic counts

The forecasts for VMT and VHT in the study area are expected to follow the region's forecasted trend of a greater than 50 percent increase between 1999 and 2020. **Table 3-3** presents the historical growth in VMT and VHT for the I-405 study area from 1980 to 2000, including the 2020 No Action Alternative, and the growth for the four-county region during the same time period.

Table 3-3: VMT and VHT for Study Area and Region

	VMT (Daily)		VHT (Daily)	
Year	Study Area (trips within)	Region-wide	Study Area (trips within)	Region-wide
1980	9,322,000	39,500,000	359,800	1,411,000
1990	14,962,400	63,400,000	529,100	2,075,000
1995	16,346,000	69,412,000	586,000	2,295,000
2020 No Action Alternative	22,510,000	100,571,000	1,156,000	3,948,000
Change vs. 1995 (%)	37.7%	44.9%	97.3%	72.0%

Source: PSRC and PSRC model

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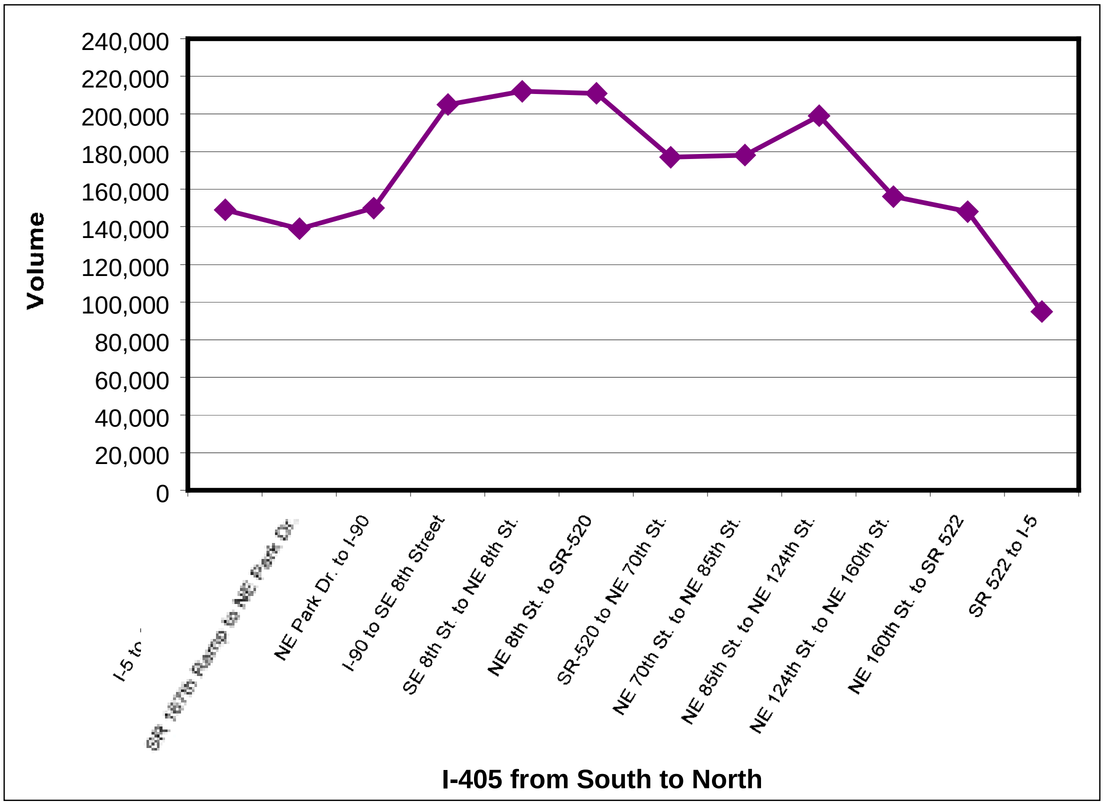
3.4.3 Daily Traffic Volumes on I-405

WSDOT's most recent traffic count data (1999, unadjusted) shows the lowest I-405 traffic volumes, 95,000 vehicles per day, in the north end between SR 522 and I-5 at Swamp Creek, and the highest, 210,000 vehicles per day, between I-90 and SR 520. The section south of Kirkland to SR 520 carries 185,000-195,000 vehicles per day, and the section south of I-90 typically carries 150,000 vehicles per day. **Figure 3.7** shows these findings.

This variation in traffic volumes is the result of different travel demands within the corridor as well as the available capacity on the freeway. The total number of freeway travel lanes (both directions) along I-405 varies from 6 to 9 (including the HOV lanes) except in the far north end where there are currently only 4 lanes. If one calculates an average "volume per lane" within the corridor, it shows that I-405 is consistently used at a similar level of demand throughout the corridor.

Figure 3-7: 1999 Daily Traffic Volumes on I-405



Source: WSDOT

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3.4.4 Peak Hour Traffic Volumes on I-405

During the morning and evening peak hours, traffic volumes fluctuate throughout the corridor, although the fluctuation is not as large as the daily fluctuations. **Figures 3-8** and **3-9** show northbound and southbound traffic volumes for general-purpose lanes and for HOV lanes during the morning peak hour.

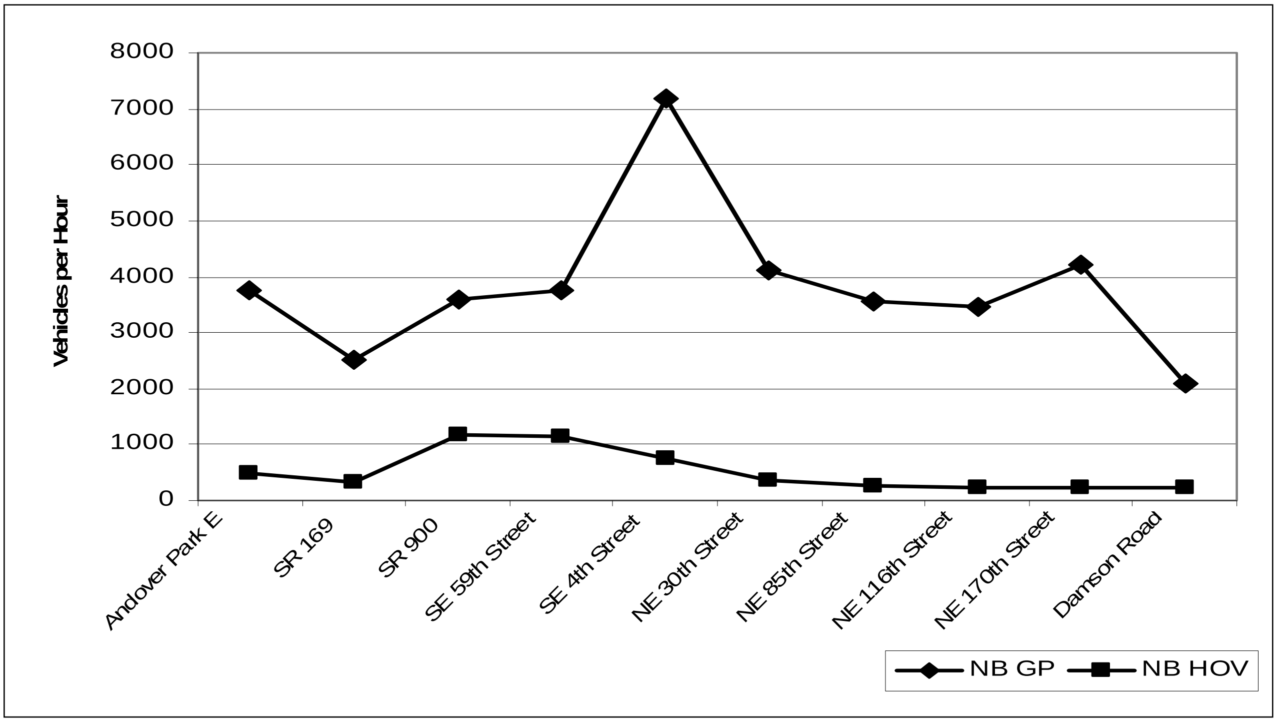
➤ In the northbound direction on I-405 (Figure 3-8), the general-purpose lanes in the Bellevue area carry the highest morning peak hour volumes, up to 7,000 vehicles per peak hour, tapering off to the north and south.

➤ In the northbound direction, the highest HOV volume in the morning peak hour is found in the Renton area, at over 1,000 vehicles per hour. For most of the sections, northbound morning peak HOV volumes are less than 500 vehicles

➤ The highest general-purpose traffic volume southbound in the morning peak on I-405 is the section between I-90 and SR 520 through Bellevue (Figure 3-9). The morning peak hour volumes for the southbound HOV lane is relatively constant at approximately 500 vehicles, with higher volumes in the Kirkland area.

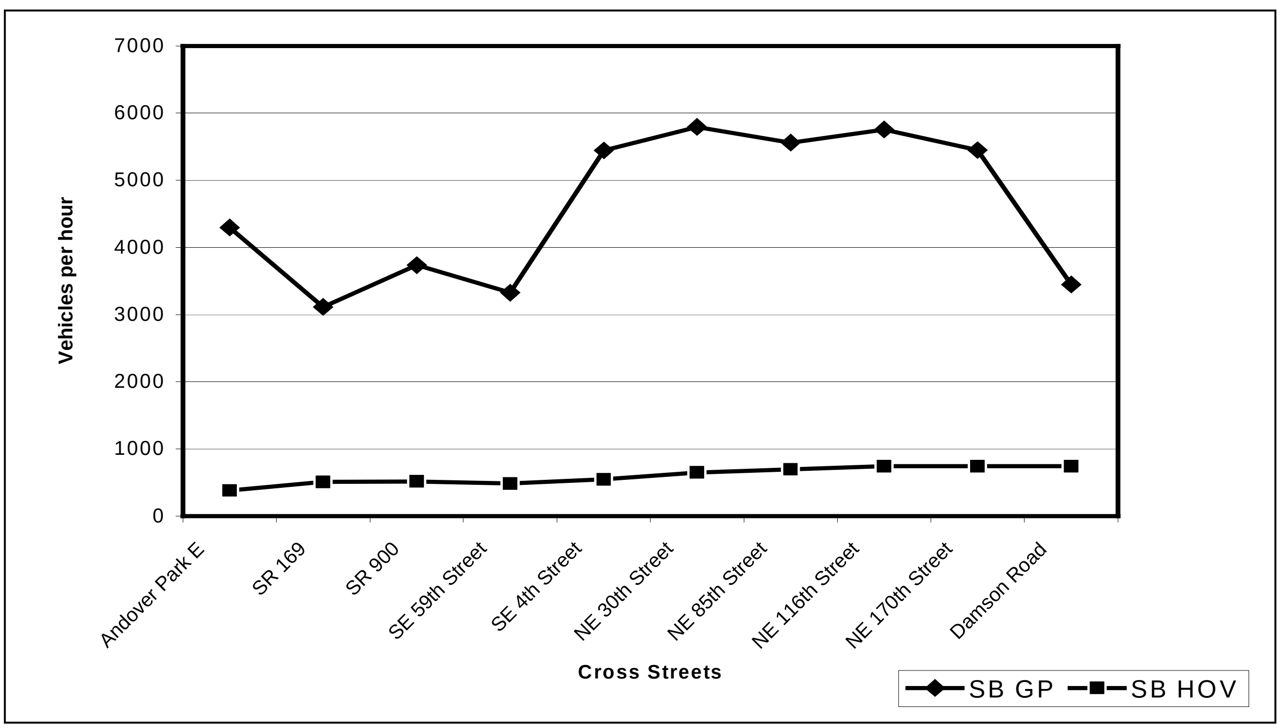
(Please note that HOV lanes are not provided in the section of I-405 north of SR 522. The HOV Volumes in that section are estimates)

Figure 3-8: I-405 Northbound AM Peak Hour Volumes



Source: WSDOT

Figure 3-9: I-405 Southbound AM Peak Hour Volumes



Source: WSDOT

Figures 3-10 and **3-11** show northbound and southbound traffic volumes for general-purpose lanes and for HOV lanes during the evening peak hour.

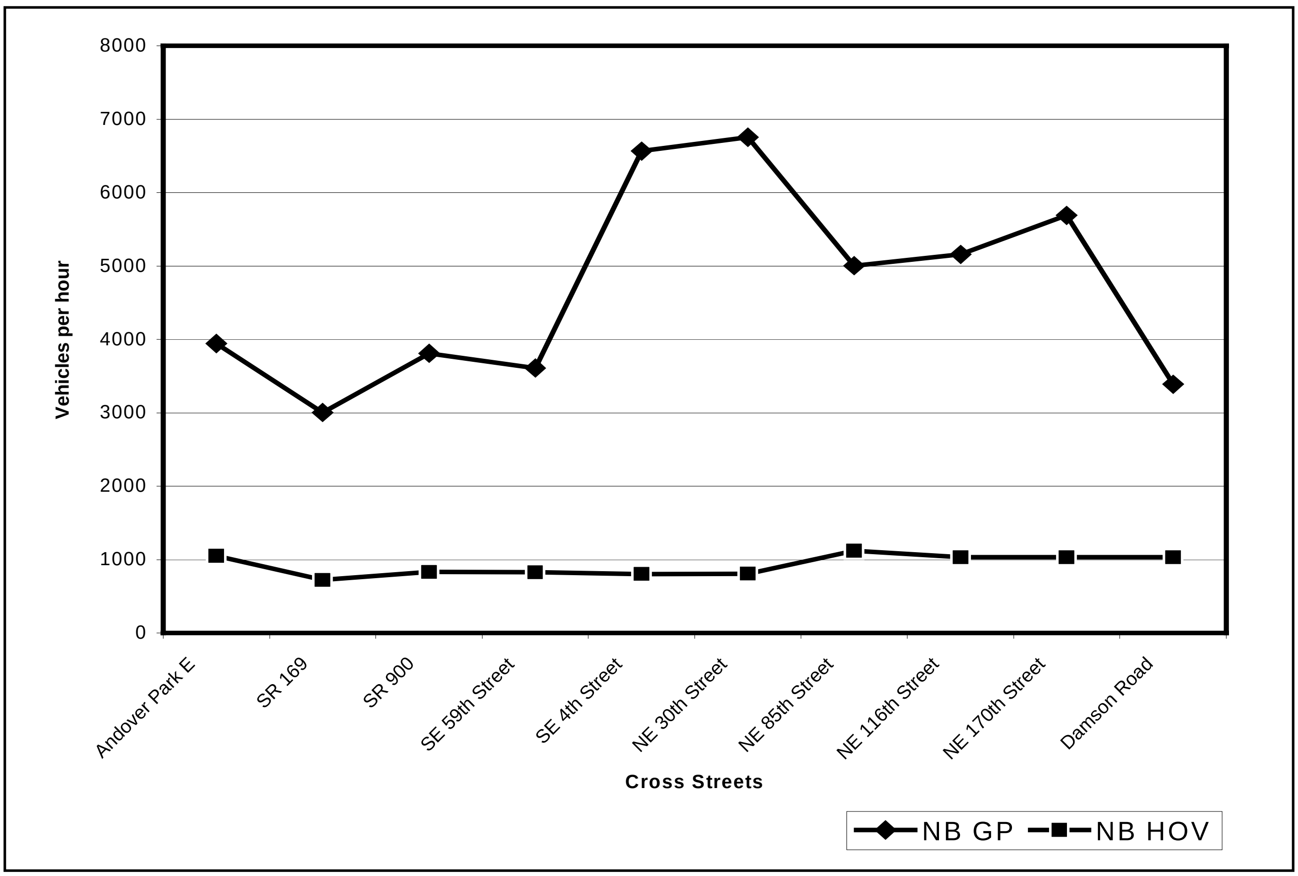
- During the **evening peak hour**, general-purpose traffic volumes in the northbound direction are generally higher than the morning peak hour, averaging 6,000 to 7,000 vehicles per hour from Renton to Bothell.

- The northbound HOV lane consistently carries about 1,000 vehicles during the evening peak hour throughout the corridor.

- Southbound evening peak hour general capacity lanes carry between 3,500 and 5,000 vehicles per hour, with the exception of the downtown Bellevue area, which reports over 6,000 vehicles per hour. These volumes are somewhat lower than the northbound direction, which has more capacity constraints in the southbound direction than the northbound direction in those areas.

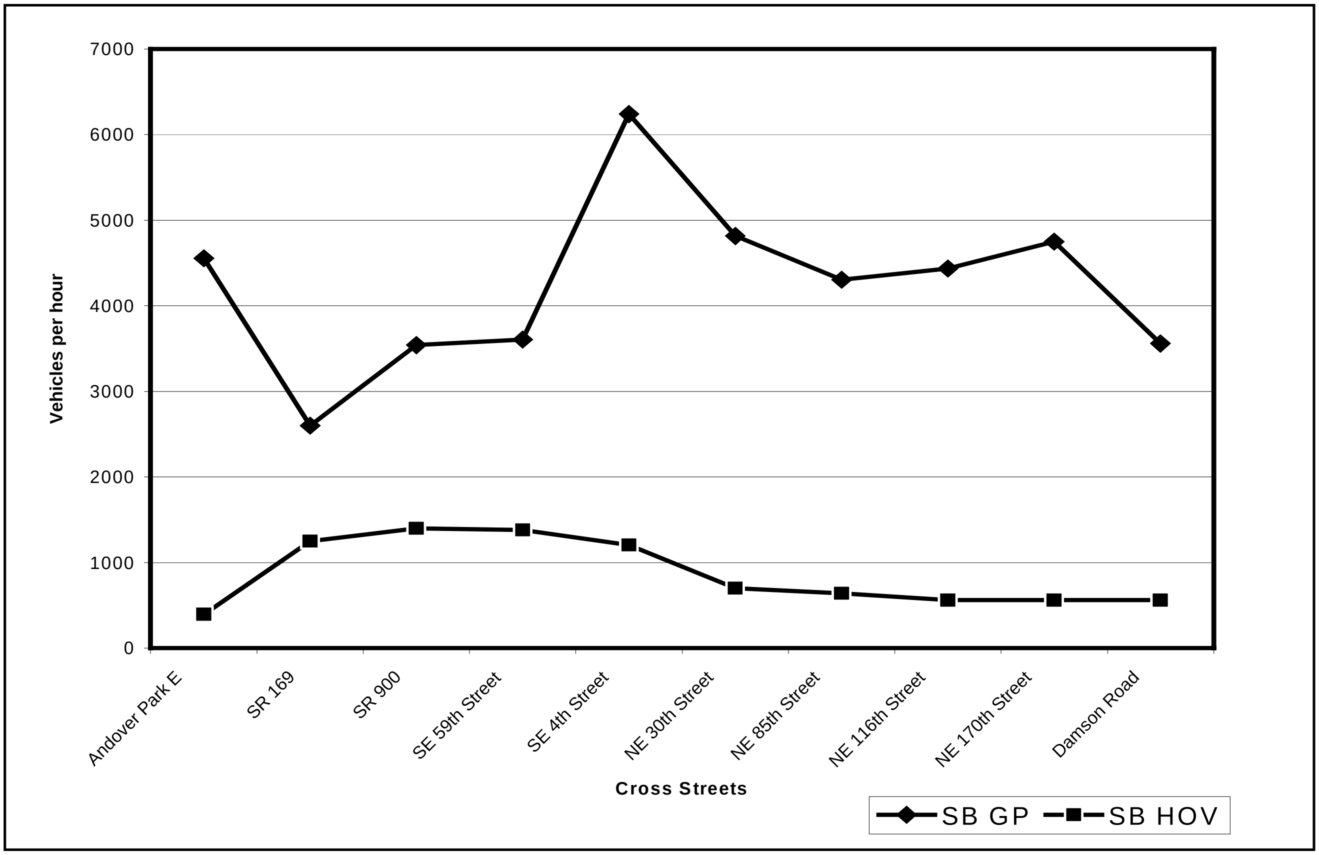
- The southbound evening HOV lanes carry the highest volumes, approximately 1,200 vehicles per hour, between Bellevue and Renton.

Figure 3-10: I-405 Northbound PM Peak Hour Volumes



Source: WSDOT

Figure 3-11: I-405 Southbound PM Peak Hour Volumes



Source: WSDOT

3.4.5 Study Area Traffic Volumes

While I-405 carries the highest traffic volumes within the study area, major arterials that parallel or intersect the highway system provide vital roles in carrying regional traffic. I-405 typically carries 60 to 70 percent of the total daily traffic volumes passing though the study area in the north-south direction. Conversely, the arterial streets carried 30 to 40 percent. In the east-west direction, the arterial street system plays an important role, with volumes almost equally distributed between the arterial streets and the two east-west freeways, I-90 and SR 520.

The principal arterials carrying significant amount of regional traffic, some of which are designated as state routes, are listed with average daily traffic volumes in **Table 3-4**. Although the table is not intended to show all of the principal arterials, it shows that many of the Eastside's arterials carry high levels of traffic, over 30,000 vehicles per day. For example, SR 908 (NE 85th Street) east of I-405 in Kirkland carries over 46,000 vehicles per day. One of the north-south arterial streets is 148th Avenue; as shown in the table, the arterial carries roughly 35,000 to 60,000 vehicles per day near the vicinity of SE 16th Street. Among the arterials shown in Table 3-2, SR 202 carries lower traffic volumes than the others because it is a two-lane highway serving the eastern edge of the study area, where rural lands still remain. As the urbanization occurs along this roadway, traffic volumes will increase in the future.

Table 3-4: Arterial Average Daily Traffic (ADT) Table

Arterial	ADT
SR-527, north of I-405	30,000 [a]
SR-522, west of I-405	38,000 [a]
SR-202, north of Woodinville-Redmond Rd.	16,000 [a]
SR-202, north of NE 116th Street	16,000 [a]
NE 124th Street, east of I-405	37,200 [b]
SR-908, east of I-405	46,300 [b]
NE 8th Street, east of I-405	37,200 [c]
148th Avenue SE, south of SE 16th Street	39,700 [c]
Coal Creek Parkway, east of I-405	37,400 [c]
SR-900, east of I-405	22,000 [a]
SR-181, south of I-405	30,000 [a]

a-1999 Annual Traffic Report, WSDOT

b-City of Kirkland, 1999 traffic counts

c-City of Bellevue, 2000 traffic counts

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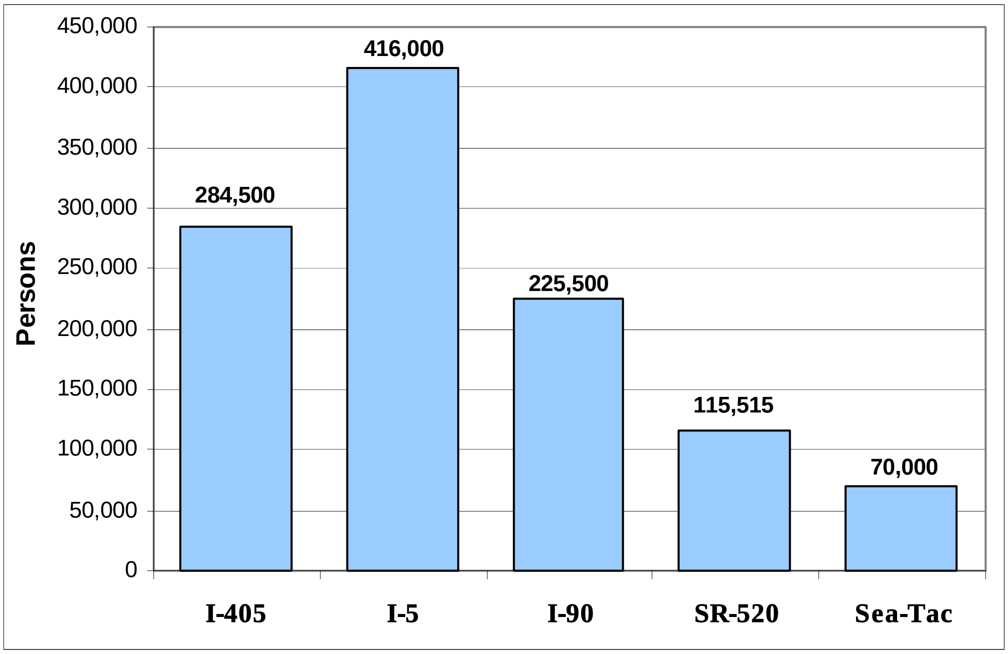
3.4.6 Person Movement

As shown in **Figure 3-12**, I-405 carried approximately 285,000 persons per day in the vicinity of SR 520 in 1998 . This figure is higher than I-90 or SR 520 but less than I-5. Interestingly, another major transportation facility Sea-Tac Airport handled about 70,800 persons per day in 1998.

Figure 3-12: 1998 Person Throughput for Major Freeways and Sea-Tac Airport



Source: WSDOT Traffic Data; Mirai Associates

3.5 TRAVEL TIME

Travel time is an important indicator of transportation mobility within the study area. Two aspects of travel time are discussed in this section.

- Travel times between origins and destinations
- Reliability of travel time

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3.5.1 Travel Times between Origins and Destinations

Travel times vary widely within the I-405 study area, depending upon the origin and destination of the trip and the mode of travel being used. **Table 3-5** summarizes typical PM Peak Hour travel times (1995 data) for a variety of study area trips, averaging around 23 miles in length. The times are for door-to-door travel, including in-vehicle time and access to the trip's origin and destination. The fastest trips are by typically by HOV mode, particularly for longer trips along I-405 that can take full advantage of the HOV lane system. Traveling along the full length of I-405 during the peak period can take longer than one hour for general traffic. Transit travel times are often at least twice as long as driving the equivalent distance, especially for people walking to the transit stops. Transit travel times are 10-15 percent faster for park-and-ride access trips.

The portion of the trip that is "in-vehicle" varies considerably between modes. These relationships are consistent for the trips shown in **Table 3-5**.

- General traffic = 75-85 percent of total time is in-vehicle time
- HOV traffic = 60-70 percent of total time is in-vehicle time
- Transit = 45–60 percent of total time is in-vehicle time

Table 3-5: Comparison of Typical I-405 Study Area PM Peak Hour Travel Times by Mode

Trip	Distance (Miles)	General Traffic Travel Time (Min)	HOV Travel Time (Min)	Transit Travel Time- Walk Access (Min)	Transit Travel Time- Park-and-Ride Access (Min)
Bellevue CBD to Federal Way/Kent	**25**	56	40	95	83
Renton to Mill Creek	**33**	65	49	125	105
Bellevue CBD to Edmonds/Lynnwood	**19**	42	38	85	76
Bellevue CBD to Seattle CBD	**10**	28	31	50	56
Tukwila/Sea-Tac to Redmond/Overlake	**23**	49	39	116	103
Issaquah/Cougar Mt. to Bothell/Kenmore	**23**	46	39	108	98
Issaquah/Cougar Mt. to Federal Way/Kent	**23**	56	47	132	118

Source: PSRC Model- 1995 base year

3.5.1.1 Predictability of Travel Time

The reliability of travel times can be defined as the deviation from the mean travel time, when travelers in the same transportation mode repeat their trips with identical travel routes starting at a same time of day. A transportation system is said to be providing a good level of service when travelers experience the same travel time, every time, or with small degrees of travel time deviations from the mean. If this occurs consistently throughout a long period of time, high levels of traveler satisfaction can be obtained.

The Washington State Transportation Center (TRAC) has conducted research to measure the performance of the freeway system in the Central Puget Sound area, including travel time reliability measures for I-405. The results of the most recent analysis results are described in the report entitled *Central Puget Sound Freeway Network Usage and Performance, 1999 Update, Volume 1* (Washington State Department of Transportation and Washington State Department of Transportation). The TRAC study measured travel times for four origin-destination trips on I-405: Tukwila to Bellevue Central Business District (CBD), Bellevue CBD to Tukwila, SR 522 to Bellevue CBD and Bellevue CBD to SR 522. The following section summarizes these findings.

3.5.1.1.1 Predictability of Travel Times for Trips from Tukwila to Bellevue CBD

According to the 1999 TRAC update, the average trip time from Tukwila to Bellevue CBD is about 13 minutes for the evening period after 6:30 PM, throughout the night, and in the early morning period before 6:30 AM. This suggests that if there is no traffic congestion, most vehicles can complete the trip in a 12 to 13 minutes. During the AM peak hour (7:30 AM to 8:30 AM) the average trip time extends to 30 minutes, twice as long as the free flow travel time. In addition, the 90-percentile trip time becomes 40 minutes. The travel time reliability during the AM peak hour is extremely poor for these trips.

The average travel time of the AM peak period (6:30 AM to 9:30 AM) is a few minutes shorter than that of the peak hour, as is the 90-percentile travel time. The gap between the travel times is very wide indicating that travel time reliability during the AM peak period is very poor.

The travel time reliability during the mid-day period (9:30 AM to 3:00 PM) improves slightly. The average travel time is about 18 minutes; the 90-percentile travel time is 22 minutes. The earlier gap between the two travel times is still present during the mid-day period, indicating there are still some travel time reliability problems during this period.

Travel time during the afternoon peak period (3:00 PM to 6:00 PM) gets slightly longer than the mid-day period. The travel time gap between the average and 90-percentile travel times widens to 21 minutes of average travel time and 25 minutes for the 90-percentile travel time.

In summary, the existing travel time reliability for the vehicles traveling from Tukwila to Bellevue CBD is very poor during the mid-day and evening periods and extremely poor during the morning peak period.

3.5.1.1.2 Predictability of Travel Times for Trips from Bellevue CBD to Tukwila

If there is no traffic congestion from Bellevue CBD to Tukwila, most vehicles can complete the trip in 12 to 13 minutes. During the AM peak hour (7:30 AM to 8:30 AM), the average trip time is slightly slower, 18 minutes, which indicates that the traffic congestion in the southbound direction in the AM peak hour is not as severe as the northbound direction. The 90-percentile travel time is about 22 minutes.

Travel time reliability during the mid-day period (9:30 AM to 3:00 PM) improves slightly. The average travel time is about 15 to 18 minutes, the 90-percentile travel time is 19 to 22 minutes during the mid-day. The gap between travel times is still present during the mid-day period showing that travel time reliability problems still exist mid-day.

For trips from Bellevue CBD to Tukwila, significant traffic slowdowns begin at 3:00 PM and stay throughout the evening period until 6:30 PM. The gap between the average travel time and 90-percentile travel time is the widest at 3:00 PM in this direction of travel. The average travel time at 3:00 PM is about 27 minutes; the 90-percentile is 36 minutes. The travel time reliability for the trips from Bellevue to Tukwila is very poor from about 2:30 PM to 6:30 PM.

In summary, the existing travel time reliability for the vehicles traveling from Bellevue CBD to Tukwila is poor throughout the day (from 6:00 AM to 6:30 PM). The travel time reliability during the afternoon peak period is very poor and the traffic flows are highly unstable.

3.5.1.1.3 Predictability of Travel Times for Trips from Bellevue CBD to SR 522

The average travel time and 90-percentile travel time data for trips from Bellevue CBD to SR 522 during a 24-hour period indicate that those trips are relatively reliable except during the afternoon/evening peak period from 3:00 to 7:00 PM. The average trip time under free flow conditions is 10 minutes. Almost all trips are one minute slower than the free flow during the non-PM peak. times.

Travel time reliability is not good for trips taken during the PM peak period. when the average travel time is about 18 minutes, and the 90-percentile travel takes 26 minutes. The most unreliable travel time period is relatively short, for one and half-hours from 4:00 - 5:30 PM.

Travel time reliability for trips from Bellevue CBD to SR 522 is relatively poor during the PM peak period. Travelers starting trips during other time periods experience good travel time reliability.

3.5.1.1.4 Predictability of Travel Times for Trips from SR 522 to Bellevue CBD

For trips taken from SR 522 to Bellevue CBD, travel time reliability problems occur mostly in the morning peak period from 7 :00 - 10:00 AM. There is a slight problem during the PM peak period (3:00 to 6:00 PM).

Reliability of travel times for the trips from SR 522 to Bellevue CBD are confined to the AM peak period. In the morning, the degradation of average travel time accelerates reaching a peak at 8:00 AM. Travel times gradually improve about 10:00 AM. The 90-percentile travel time follows a similar pattern. The gap between the average and 90 percentile travel times is the greatest at 8:00 AM with a gap of about four minutes. This gap is relatively narrower than other congested areas in the I-405 corridor during the AM peak period.

3.6 CONGESTION

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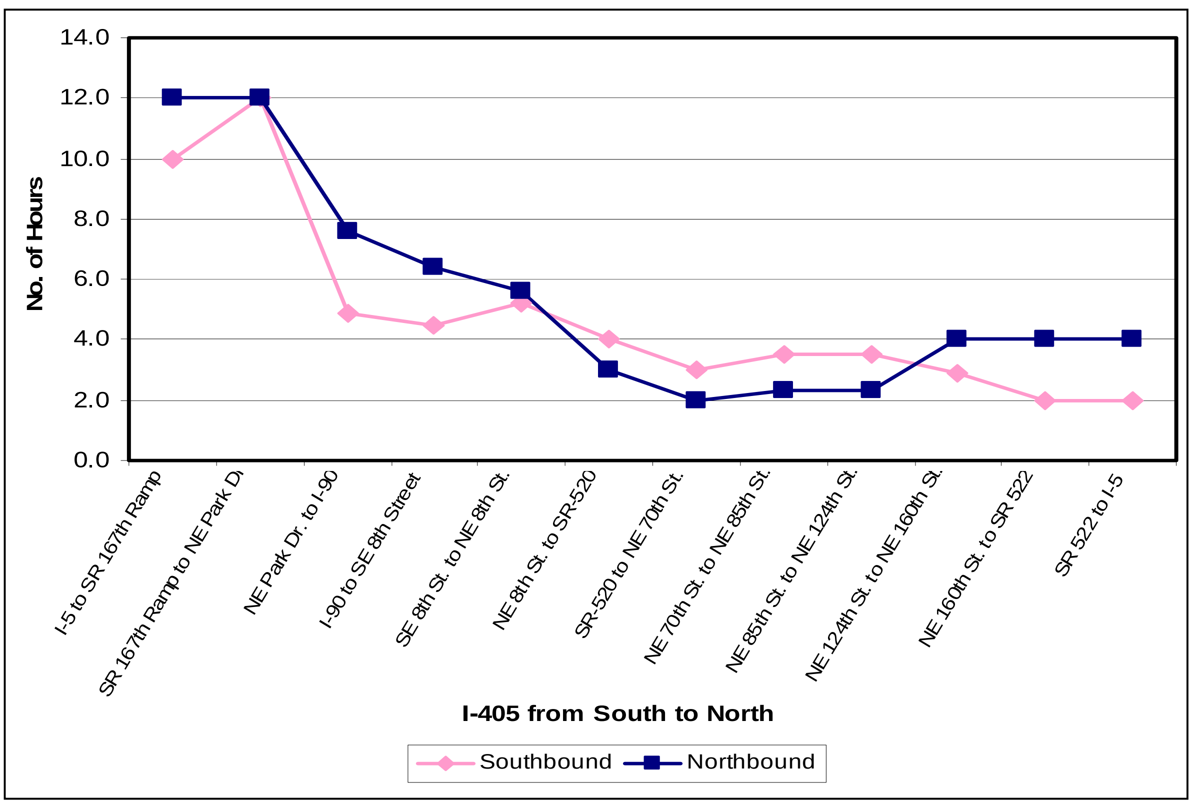
3.6.1 I-405 Congestion

Traffic congestion along I-405 is widespread during the morning and afternoon peak periods and has spread to surrounding time periods. A useful way to examine daily congestion is to look at the number of hours during which a facility is congested. For purposes of this analysis, "congestion" on the freeway is defined as travel speeds below 45 mph.

Figure 3-13 illustrates the severity of traffic congestion that was present in 1997 at 12 points along I-405. The duration of traffic congestion in the northbound and southbound directions is roughly the same. The most congested area of I-405 is from I-5 in Tukwila to NE Park Drive in the City of Renton. Traffic congestion for 10-12 hours a day is typical in this section. For most other sections, traffic congestion lasts 2 to 7 hours a day.

Figure 3-13: Hours of Traffic Congestion on I-405



Source: PSRC Model, Mirai Associates

What causes this variation in congestion? As discussed previously, the average daily "volume per freeway lane" is quite consistent throughout the corridor. Therefore, traffic volumes alone do not cause congestion. The most likely reason for the high hours of congestion in the south end of I-405 relates to freeway "friction" caused by curving geometrics (e.g. the "S-Curves"), grades (e.g. Kennydale Hill), and complex interchanges at I-5 and SR 167. These factors will be examined in detail in the environmental studies.

3.7 TRANSIT

3.7.1 Transit Providers

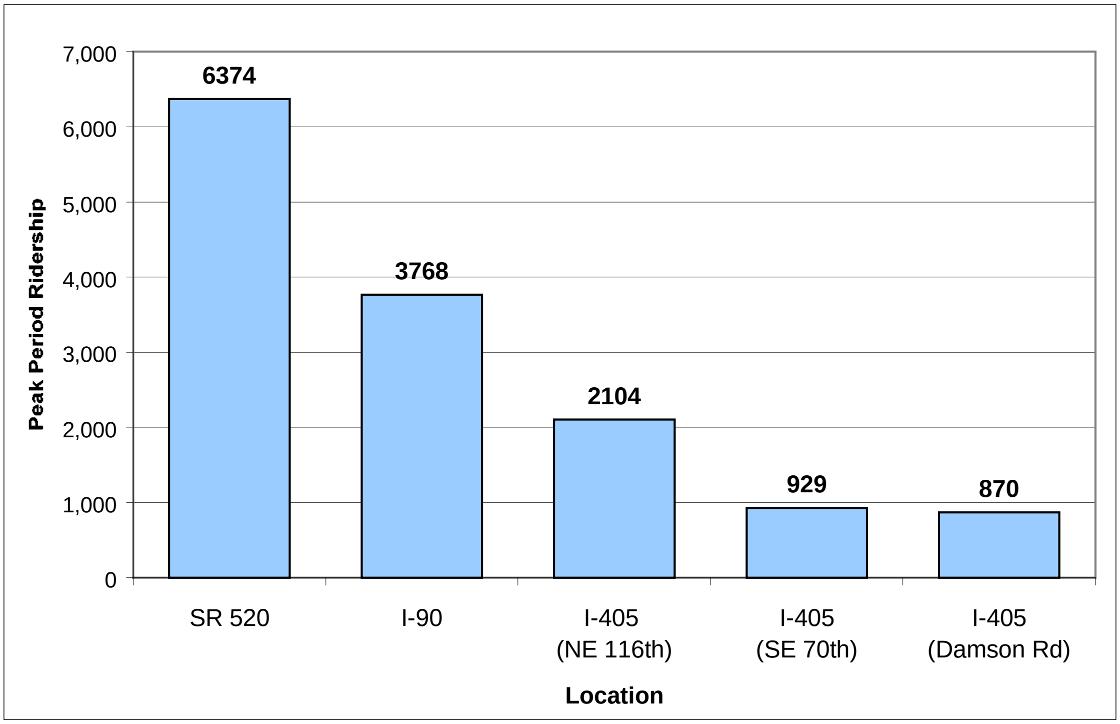
King County Metro, Sound Transit and Community Transit currently provide transit service in the study area. King County currently provides local service between and within Eastside communities and provides express service between major urban centers. Community Transit provides express service between urban centers in Snohomish County and the Eastside. Sound Transit began express service between selected urban centers in Fall 1999, as of April 2001, 14 of 18 route commitments from Sound Move are operational. Sound Transit's Regional Express is currently in the planning and early design stages of new park-and-ride lots; transit centers and direct access ramps, including large-scale improvements to several I-405 interchanges. Historically, King County Metro service primarily served downtown Seattle, the University of Washington and Downtown Bellevue. This is a hub and spoke system based primarily on these three activity centers with downtown Seattle being predominant. Bus service for the I-405 study area is now beginning to serve multiple activity centers. This type of service concept will greatly increase the convenience of making trips between eastside activity centers as opposed to focusing on select hubs. King County Metro's 6-year plan and the new Sound Transit Plan are being developed around this regional transit service concept.

3.7.2 Transit Ridership

Transit ridership numbers and bus volumes published in 1998 in the *Trans-Lake Washington Study* show that I- 405 is served by 15 Metro and Community Transit bus routes between SR 522 and SR 520, while 13 bus routes serve I-405 between SR 520 and I-90. Transit ridership on I-405 between SR 520 and Totem Lake averages 3,910 passengers per day traveling on 178 transit vehicles. Approximately 3,435 passengers travel during the peak periods on 147 transit vehicles. This is over 85 percent of the daily traffic traveling during the peak periods. Transit ridership on I-405 between 112th Avenue SE and SE 8th Street averages 2,020 passengers per day on 128 transit vehicles. Approximately 1,645 passengers travel on 87 transit vehicles during the peak periods. This is over 80 percent of the daily volume traveling during the peak periods.

Transit data were collected on northern and southern segments of I-405 to supplement the transit ridership data published in the Trans-Lake Washington Study. AM and PM peak period ridership data (four-hour totals) were collected from King County and Community Transit for Fall 1998. A summary of peak period ridership is shown in **Figure 3-14**. The graph shows the area of highest peak period transit ridership occurs on the SR 520 bridge (6,400 riders) followed by I-90 between Seattle and Bellevue (3,800 riders). The segment of I-405 with the highest peak period transit ridership is between SR 520 and the Totem Lake area (2,100 riders). Transit ridership near each of the northern and southern termini of I-405 is less than 1,000 riders during peak periods.

Figure 3-14: 1998 Peak Period Transit Ridership on I-405



Peak Period = 4 Total Hours AM & PM
Source: WSDOT

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3.7.3 Park-and-Ride Lots

King County and Community Transit serve park-and-ride lots located in the study area. There are 26 permanent park-and-ride lots and 32 leased park-and-ride lots in the primary study area, most of which are located in King County. The total number of available park-and-ride spaces is 9,543, 83 percent of which are in the permanent lots. Although the average utilization among the permanent lots is 84 percent, parking demand for many of the permanent lots exceeds 100 percent. Those lots currently experiencing more than 100 percent utilization are as follows: Bothell, Brick Yard, Eastgate, Evergreen Point, Mercer Island, South Bellevue, Wilburton, Kent/Des Moines, South Renton, Tukwila, and Renton Boeing Lot 6. The average utilization of the leased lots is 55 percent. Many of the leased lots are relatively small, with fewer than 50 available parking spaces. **Table 3-6** lists the permanent park-and-ride lots in the study area.

Table 3-6: Study Area Permanent Park-and-Ride Lots - Total Spaces and Utilization

	Spaces	Count	% Used
North District and Snohomish County			
Canyon Park	292	253	87%
Bothell	230	291	127%
Kenmore	432	401	93%
Northshore	376	147	39%
Woodinville	459	245	53%
East District			
Brickyard Road	247	265	107%
Bear Creek	334	158	47%
Eastgate	678	738	109%
Evergreen Point Bridge	51	51	100%
Northeast 116th & I-405	24	2	8%
Houghton	450	253	56%
Kingsgate	502	389	77%
SR 908/Kirkland Way	20	14	70%
Mercer Island	244	248	102%
Newport Hills	292	238	82%
Northup	32	14	44%
Overlake	395	204	52%
Preston	53	22	42%
Redmond	344	234	68%
South Bellevue	470	557	119%
South Kirkland	603	552	92%
Wilburton	190	220	116%
South District			
Kent/ Des Moines	384	389	101%
Renton Highlands	146	88	60%
South Renton	370	372	101%
Tukwila	307	317	103%
Total	**7925**	**6662**	**84%**

Source: King County and Community Transit, January 1999

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3.7.4 Vanpools

Vanpools provide additional transit service to the corridor. Vanpools generally carry pre-registered commuters from their homes or park-and-rides to their places of work. An average vanpool carries about 9 passengers per trip. Approximately 159 vanpools travel along some part of the I-405 corridor with an estimated ridership of 1,430 riders per day.

3.8 NONMOTORIZED FACILITIES

The bicycle and pedestrian facilities in the study area include dedicated trails, sidewalks, and bike lanes. Long commute trips by nonmotorized modes can be problematic due to the lack of north-south arterials, topography, and transportation infrastructure like highways and cul-de-sacs. However, walking and bicycling accounts for up to 5 percent of total daily trips in the study area. To accommodate the bicycling demand, in 1994 King County's entire bus fleet was equipped with bicycle racks that can carry two bicycles. Metro estimates that their buses transport 465,000 bikes a year. Another program King County and Community Transit offer combines biking with transit by providing bike racks and lockers at park-and-ride lots and transit centers.

There is no existing document or data on pedestrian and bicycle deficiencies area-wide. However, discussions with King County bicycle and pedestrian planners have identified that I-405 itself is often a major impediment to nonmotorized connectivity.

3.9 FREIGHT MOVEMENTS

The central Puget Sound region serves as an important freight gateway to Pacific Rim countries. Automobiles, forest and agricultural products, communications and computer equipment and hundreds of other items continuously move over the region's roadways, and railroads, to seaports and airports. The latest data indicate that the region's roadways carry approximately 1.2 million truck trips each day, with about 70 percent of those trips occurring within King County. I-405 carries a significant portion of those trips, moving up to 90 percent of the total truck origins and destinations in east King County. Truck volumes along I-405 are expected to grow by 50 percent by the year 2010.

At the same time, the decreasing reliability of the regional transportation system, including I-405, is creating a serious problem for regional freight mobility. Significant delay as a result of transportation system congestion is costing the region's businesses nearly $700 million a year according to information from the WSDOT Office of Urban Mobility (the cost to the freight industry itself is estimated to be around $200 million per year). Reductions in system reliability and resulting higher transportation costs increase the cost of manufacturing and distributing goods, while adversely affecting economic vitality and job creation. Accessibility to markets becomes increasingly difficult with worsening traffic congestion and delay.

Despite this increasing mobility problem, freight facilities do not currently exist on the I-405 corridor with the exception of the northbound truck climbing lane between SR 520 and NE 70th Street. I-405 continues to be used by freight carriers as an Alternative route when congestion occurs on I-5 in downtown Seattle near the convention center (one of the most significant freight mobility bottlenecks in the region). I-405 also provides ready access to the distribution centers along SR 167 in the Kent Valley. Volumes of heavy trucks on the portion of I-405 south of I-90 are about double those along the northern portion due to truck movements to and from the Kent Valley. Congestion at the SR 167/I-405 interchange is identified by truckers as one of the worst transportation system problems in the region, and the trucking community supports improvements to this major truck corridor interchange as one of its top priorities.

I-405 is also an important connecting link to Eastern Washington and the Port of Seattle via I-90. Freight moving north and south can use I-405 to reach the Ports of Tacoma and Seattle when I-5 is congested. Traffic flow to and from the ports is likely to continue, with truck trips generated by the Port of Seattle expected to double by 2020. Products shipped across I-90 from Eastern Washington also reach points north and south of Seattle via I-405. At the same time, I-405 serves as a heavily-used transport corridor for local freight delivery to and from the cities along the corridor. A large number of freight trips are ones within the region made by smaller trucks, such as delivery vans. These trips can benefit greatly from roadway improvements to I-405.

3.10 SAFETY

The overall accident rate along I-405 (1.6 accidents per million vehicle miles) is about midrange among other freeways in King County. The rates are lower than the average rate for all state highways (1.88 accidents per million vehicle miles, or MVM) and for state highways in King County (2.27 accidents per million vehicle miles). On comparable local freeways, I-5 and SR 520 both exhibit accident rates of about 2.0 accidents per MVM.

I-405 does have accident problems, however. Over the three-year period from 1994 to 1996, a total of 5,580 accidents were reported along I-405. Most collisions occurred on the mainline freeway, with about one-fourth of all accidents occurring on the ramps, collector-distributor roads, and cross streets at the interchanges. About half of all collisions involve property damage only, while half involve injuries or fatalities. This injury pattern applies equally to the mainline and ramp segments, however, all seven fatalities reported in this period occurred on the I-405 mainline.

Twenty-nine of the 280 high accident locations in King and Snohomish are located along I-405. Most high accident listings are associated with ramps connecting to I-405, including those at SR 181 (Interurban), SR 169, SR 900 (Sunset and Park), Coal Creek Parkway, SE 8th St., NE 4th St., NE 8th St., SR 908 (NE 85th St.), NE 116th St. NE 160th St, and SR 527. The portion of I-405 north of SR 527 is identified as a high accident “corridor”, due to the relatively higher speeds and consequent injuries associated with accidents in this segment.

WSDOT’s ramp metering program on I-405 has been very successful. Rear-end and sideswipe accidents have decreased by 60 percent to 70 percent near locations with ramp meters.

The accident survey also included many arterial and collector streets that connect with I-405 or provide parallel travel routes. For State roads serving as surface arterial routes, accident rates fall primarily into a range of 3 to 5 accidents per MVM. This pattern is related to the presence of traffic signals, driveways, pedestrians, and bicyclists, and lower levels of access control. Again, these levels of accident rates are typical of urban arterial facilities. Accident rates for selected arterial and collector routes in the primary study area generally range between 2 to 4 accidents per MVM, with some streets higher. These streets typically experience higher accident rates due to the presence of signalized intersections, driveways, and other conflicts.

3.11 TRANSPORTATION DEMAND MANAGEMENT

Transportation Demand Management (TDM) seeks to reduce the need for new transportation facilities by reducing the number of vehicles on the road during peak congestion periods. Implementation of the Commute Trip Reduction (CTR) act represents the most systematic approach to TDM within the I-405 corridor. In addition to the CTR law, Washington State offers several subsidies and incentives for companies and their employee to practice transportation demand management. King and Snohomish Counties offer employers an array of services and products to encourage ridesharing and transit use.

The Cities in the I-405 corridor study area have implemented strategies in addition to the transportation demand management requirements mandated by the CTR law. All of the cities impose conditions on development that either restrict parking spaces or require carpool and vanpool parking spaces. Some cities have parking management programs, and several have linked pedestrian and bicycle facility requirements to demand management objectives.

Employers in the I-405 study area are using the following transportation demand management strategies:

- Provision of preferential parking for High Occupancy Vehicles;
- Provision of commuter ride matching services;
- Provision of subsidies for transit fares,
- Provision of vans or vanpools;
- Permitting flexible work schedules to facilitate employees use of transit, carpools or vanpools;
- Permitting compressed work schedules allowing employees to work longer hours in shorter days;
- Provision of bicycle parking facilities, lockers, changing areas, and showers for employees who walk or bicycle to work;
- Provision of a program of parking incentives such as a rebate for employees who do not use the parking facilities, Establishment of a program to permit employees to work part- or full-time at home or at an Alternative worksite closer to their homes;
- Implementation of other measures designed to facilitate the use of High Occupancy Vehicles, such as on-site day care facilities and emergency taxi service.

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3.11.1 Commute Trip Reduction Program

The Washington State Legislature passed the 1991 Commute Trip Reduction law in an effort to help manage growing traffic congestion. The CTR law requires cities or counties with major employers (those that employ 100 or more full-time employees who begin their workday on two or more weekdays, between 6 and 9 am) within their boundaries to adopt a commute trip reduction ordinance and plan.

Results from a 1997 CTR survey for King County illustrates the travel modes for sample jurisdictions in the I-405 corridor study area. Affected employers within the Cities of Woodinville and Redmond report the largest reductions in SOV use from 1995 to 1997 at –10.8 and –9.8 percent respectively. Overall, five of the eight jurisdictions show reductions in SOV usage between 1995 and 1997, as shown in **Table 3-7**.

Table 3-7: 1997 CTR Program Survey Results for King County

Jurisdiction	Work Sites	SOV	Car-pool	Transit	Van-pool	Bike	Walk	Tele-com-mute	Other	SOV Change 1995-97
		%	%	%	%	%	%	%	%	%
City of Bellevue	50	71.4	17.8	6.8	1.4	0.4	0.7	0.7	0.7	-0.7
City of Kirkland	22	77.5	15.9	2.9	0.6	0.6	0.9	0.7	0.9	-4.3
City of Redmond	33	76.6	15.4	3.1	2.1	0.9	0.9	0.4	0.5	-9.5
City of Woodinville	3	68.2	27.9	0.5	0.0	2.2	0.5	0.6	0.0	-10.8
City of Bothell	13	82.5	13.5	1.0	1.4	0.5	0.2	0.3	0.5	3.8
Unincorporated King County	1	71.8	25.4	0.6	0.0	0.6	0.0	0.0	1.7	-6.4
Unassigned King County	2	91.6	7.3	0.0	0.0	0.2	0.0	0.4	0.4	2.2

Source: Washington Commute Trip Reduction Program, 1995 and 1997 Surveys

Note: No accurate 1997 survey results available for the cities of Renton and Tukwila

3.12 INTELLIGENT TRANSPORTATION SYSTEMS

Intelligent Transportation Systems (ITS) apply advanced technologies to solve transportation problems or create efficiencies in traffic movement. These types of improvements have become commonplace in North America. ITS technology is rapidly evolving. While the basics of the ITS technology have been available for many years, many of the state-of-the-art individual technologies that are being deployed today, were not available or even non-existent two years ago. This is particularly true for the area of communications with the ever changing technology for fiber optics.

ITS technologies have two major focus areas: transportation agency related information and traveler information. The technologies collect, distribute and disseminate information regarding weather, congestion, incidents, construction, tolls, fares, vehicle location, passengers, safety, emergency response/management, available services, alternate routing and facility disposition (e.g. drawbridges up or down, ferry boarding or alighting). The overall goal of these technologies is to provide all relevant information in real-time to transportation managers and users, which will result in better and faster decision making.

The I-405 Corridor is currently equipped with various ITS equipment. Surveillance cameras, in-pavement detectors, variable message signs, ramp meters and other ITS devices have been implemented along 405 by WSDOT as well as on surface streets by the cities of Renton and Bellevue. Through projects like the North Seattle Advanced Traffic Management System (ATMS), South Seattle ATMS and Smart Trek, many of the ITS devices in the I-405 corridor are accessible by multiple agencies. WSDOT, for example, can see and with a few exceptions, control the cameras deployed by the City of Bellevue, for example. This extends the abilities of transportation managers to react to events both on and off of facilities under their jurisdiction. The existing ITS implementations, properly augmented and maintained, should provide adequate coverage to this already tech-enabled corridor. **Appendix E** provides more detail on ITS in the I-405 corridor.

4. Impact Analysis

4.1 INTRODUCTION

The Alternatives were evaluated using three criteria adopted by the study committees. This chapter summarizes the results of this evaluation.

1. Improve Mobility

2. Reduce Congestion

3. Improve Safety

Study objectives criteria and performance measures are detailed in Table 2-1. The Appendices to this Report have additional information related to the evaluation of the No Action and the four Build Alternatives.

4.2 NO ACTION ALTERNATIVE

The No Action Alternative includes the funded highway and transit capital improvement projects of cities, counties, Sound Transit, and WSDOT. These projects are already in the pipeline for implementation within the next six years, and are assumed to occur regardless of the outcome of the I-405 Corridor Program.

■

4.2.1 Objective - Improve Mobility

4.2.1.1 Criterion: Serve as Much of the 2020 Peak Period Travel Demand Within the Corridor as Possible

This criterion is addressed by examining the following performance measures:

1) Person Volumes

- ➢ PM peak period person volumes by mode across 3 screenlines
- ➢ Daily person volumes by mode across 3 screenlines compared to unconstrained assignments

2) Vehicle Volumes

- ➢ PM peak period traffic volumes by types of vehicles (SOVs, HOVs, buses and trucks) at 3 screenlines
- ➢ Daily traffic volumes by types of vehicles (SOVs, HOVs, buses and trucks) at 3 screenlines

- Daily traffic volumes along segments of I-405
- Daily traffic volume shifts between facilities along selected screenlines

Daily demand values are described to place the peak period results into context with the entire day within the corridor.

4.2.1.1.1 Person Volumes

PM Peak Period Person Volumes by Mode Across 3 Screenlines

PM peak period (3 hours) travel demand was summarized as the number of persons passing through the study area at three locations, called screenlines. These screenlines (**Figure 4-1**) are imaginary lines that cut across all major roadway and transit facilities in a particular location. The three screenline locations are in Bothell (at the King/Snohomish County line), in Bellevue, and in south Renton. The results of the travel demand analysis are shown in **Figures 4-2** through **4-4**. The persons shown include users of single-occupant vehicles (SOV's and non carpools 2+), carpools 3+, vanpools, and transit. Non carpools are defined as 2 person carpools, displaced to General-purpose traffic. Commercial vehicle persons were excluded from this analysis, however, commercial vehicles are included in all vehicular totals described elsewhere. **Appendix H,** Transportation Data provides detailed supporting information for the person and vehicle volume analyses that follow in this report.

The 2020 No Action demand was compared against two benchmarks: the 1995 base conditions, and a 2020 "unconstrained" forecast. On average across the three screenlines, the No Action peak person demand is 34 percent higher than the 1995 base conditions. This demand increase is consistent with growth expectations within the study area. Most of the growth in demand occurs on the arterials parallel to I-405 rather than on I-405 itself. During peak periods, I-405 cannot absorb much more demand, resulting in growing spillover of demands to parallel arterials. This effect is shown in **Figures 4-5** through **4-7**.

The No Action demand reaches approximately 85 percent of the unconstrained demand. The remaining 15 percent can be considered as being indicative of 'unmet' person demand within the corridor. The Renton screenline shows the largest unmet peak period demand approaching 30,000 persons, or a gap of around 30 percent.

Mode usage was also examined at each screenline. This usage will be described under the criterion "Reduce Share of SOV Travel" in a later section.

Daily Person Volumes by Mode Across 3 Screenlines

Daily person volumes were analyzed at the same three screenlines. As summarized in **Figure 4-8**, the trend in daily person trips for the No Action is similar to the peak period in terms of growth trends from 1995. On average, the No Action demand approaches 80 percent of the unconstrained demand, slightly lower than during peak conditions. This condition is most pronounced at the Renton screenline, which showed an unmet daily person demand of around 33 percent.

Figure 4-1: Screenlines Used in I-405 Corridor Program Analysis

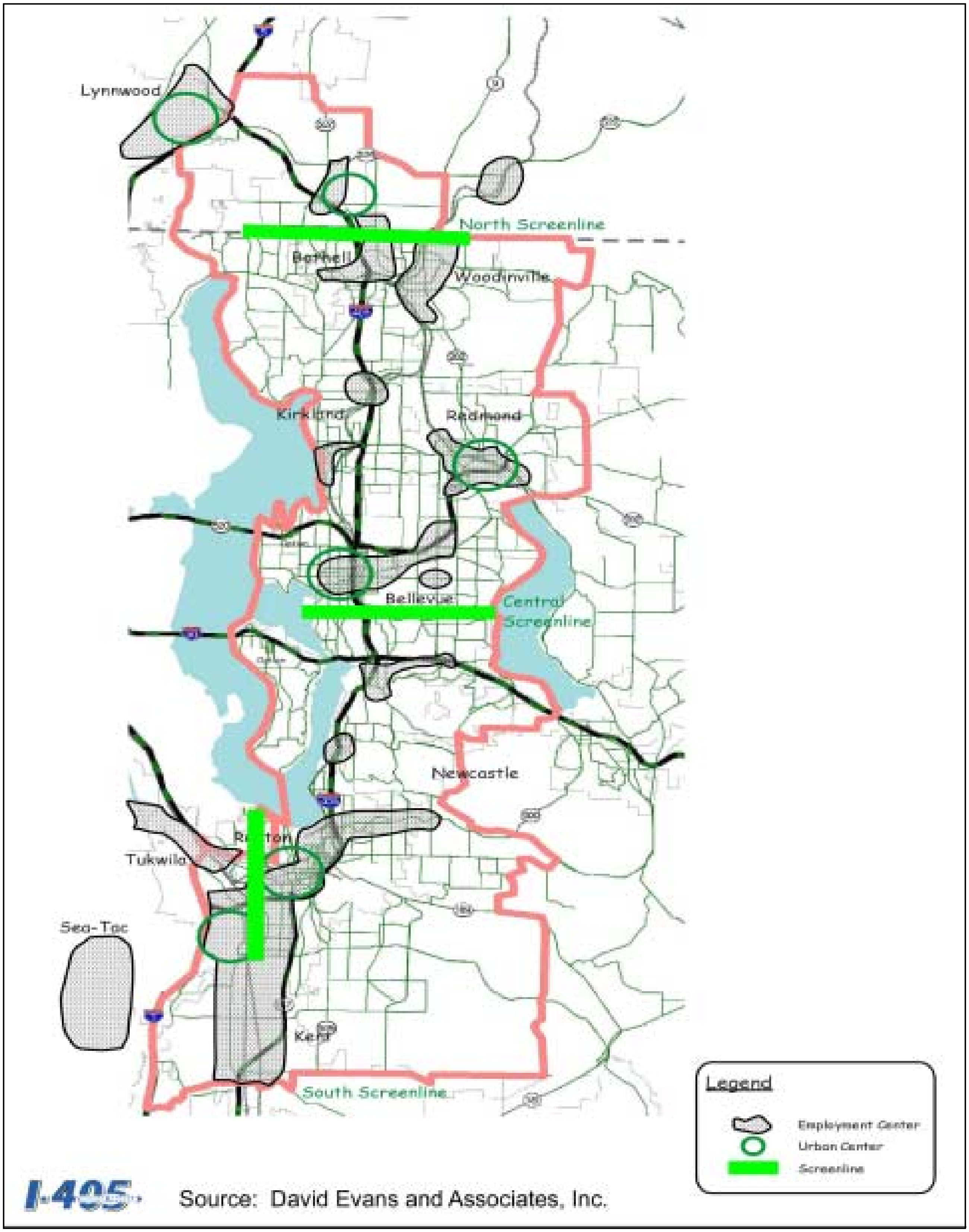
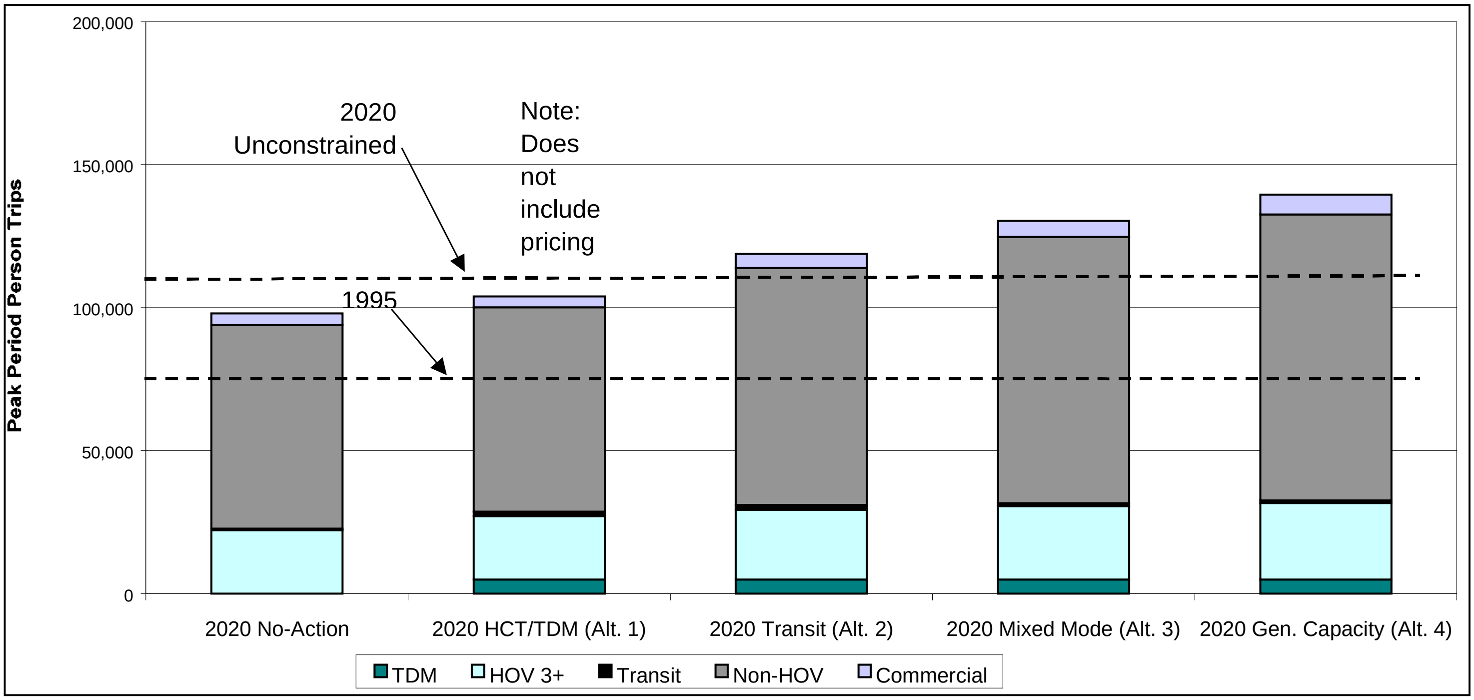
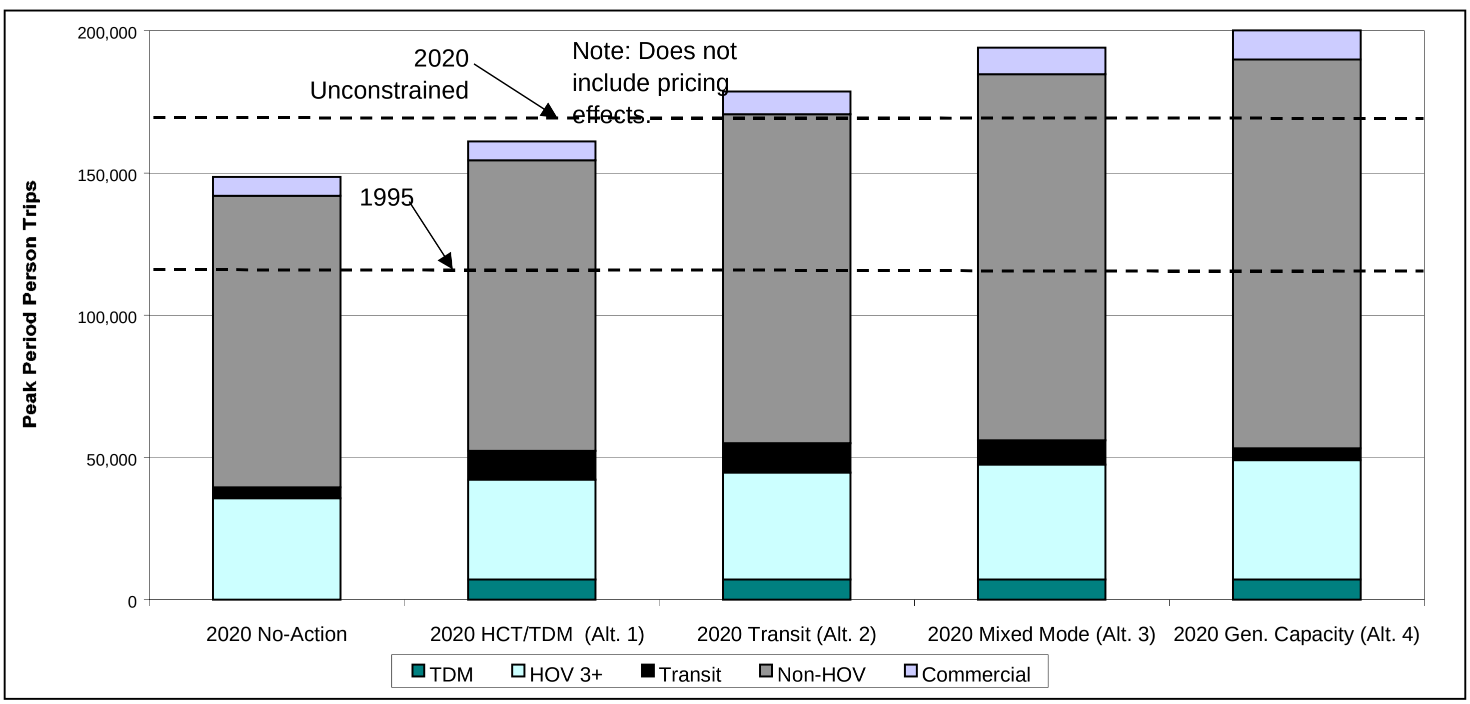


Figure 4-2: Peak Period Person Demand by Mode: Bothell Screenline



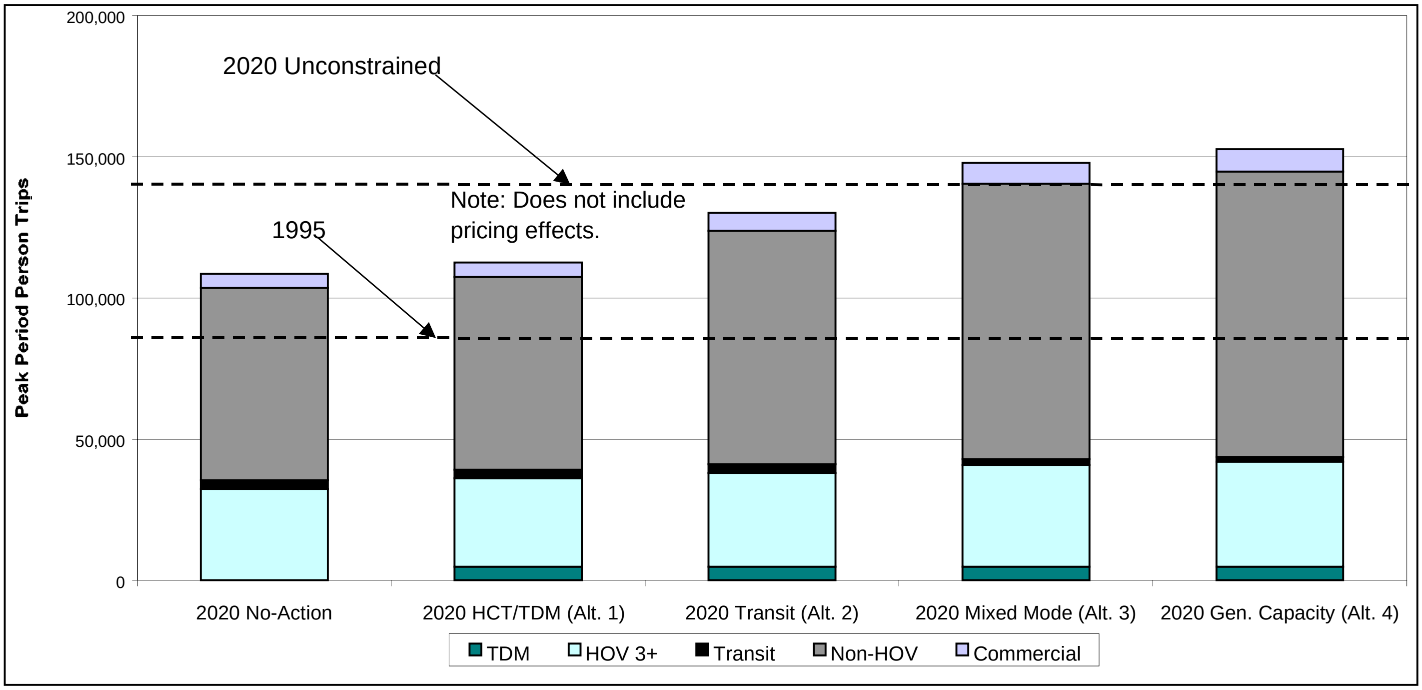
Source: PSRC Model, Parsons Brinckerhoff

Figure 4-3: Peak Period Person Demand by Mode: Bellevue Screenline



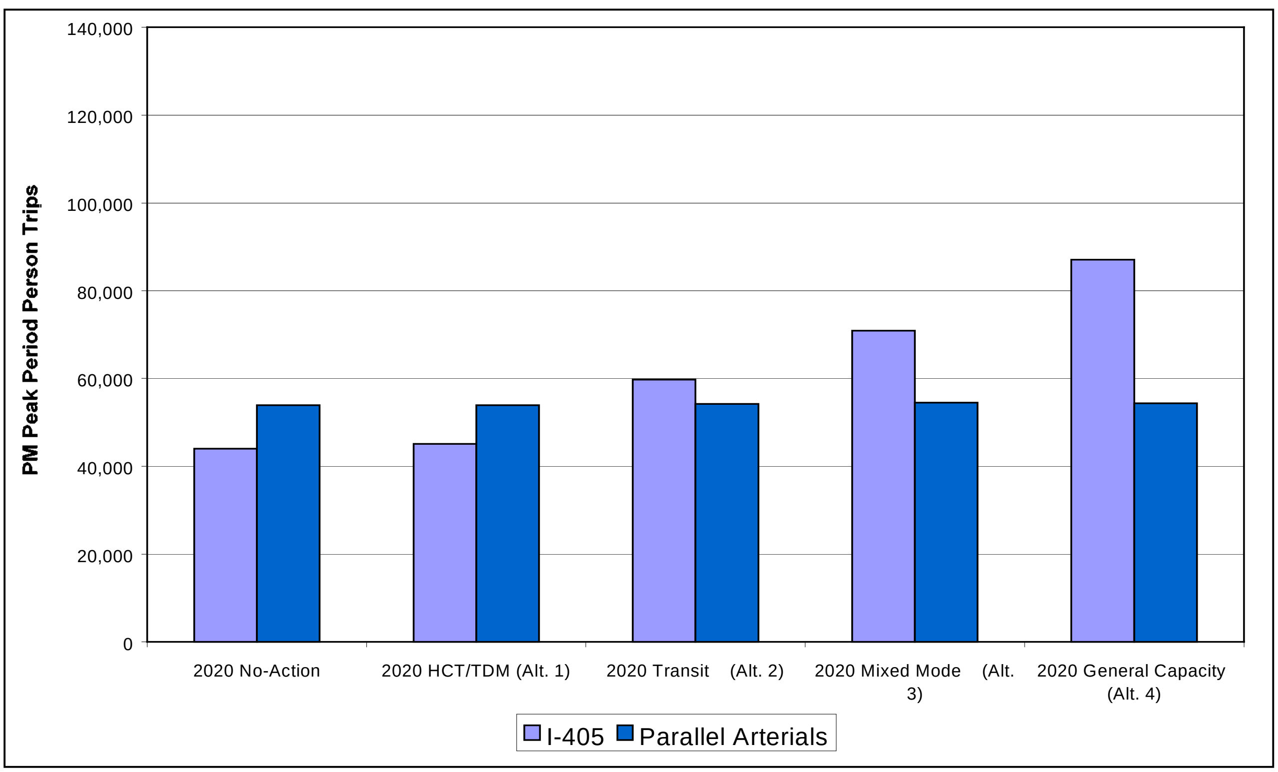
Source: PSRC Model, Parsons Brinckerhoff

Figure 4-4: Peak Period Person Demand by Mode: Renton Screenline



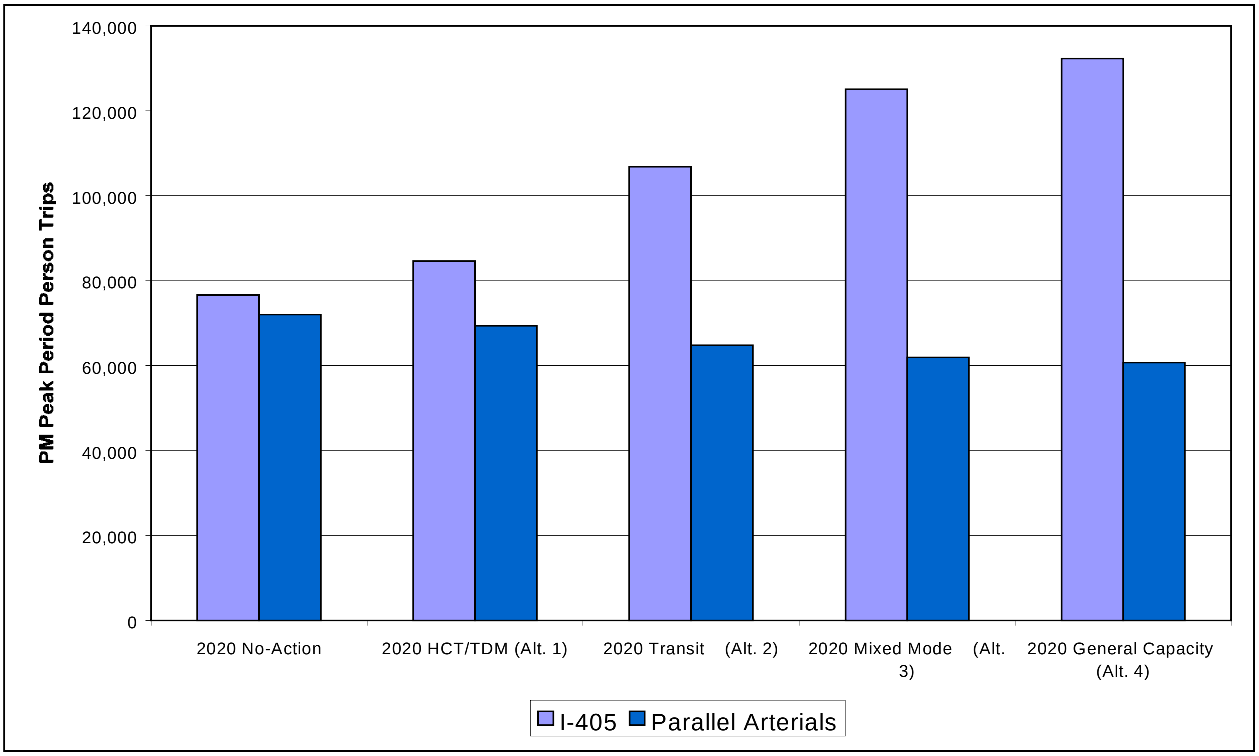
Source: PSRC Model, Parsons Brinckerhoff

Figure 4-5: Peak Period Person Demand at the Bothell Screenline: I-405 vs. Parallel Arterials



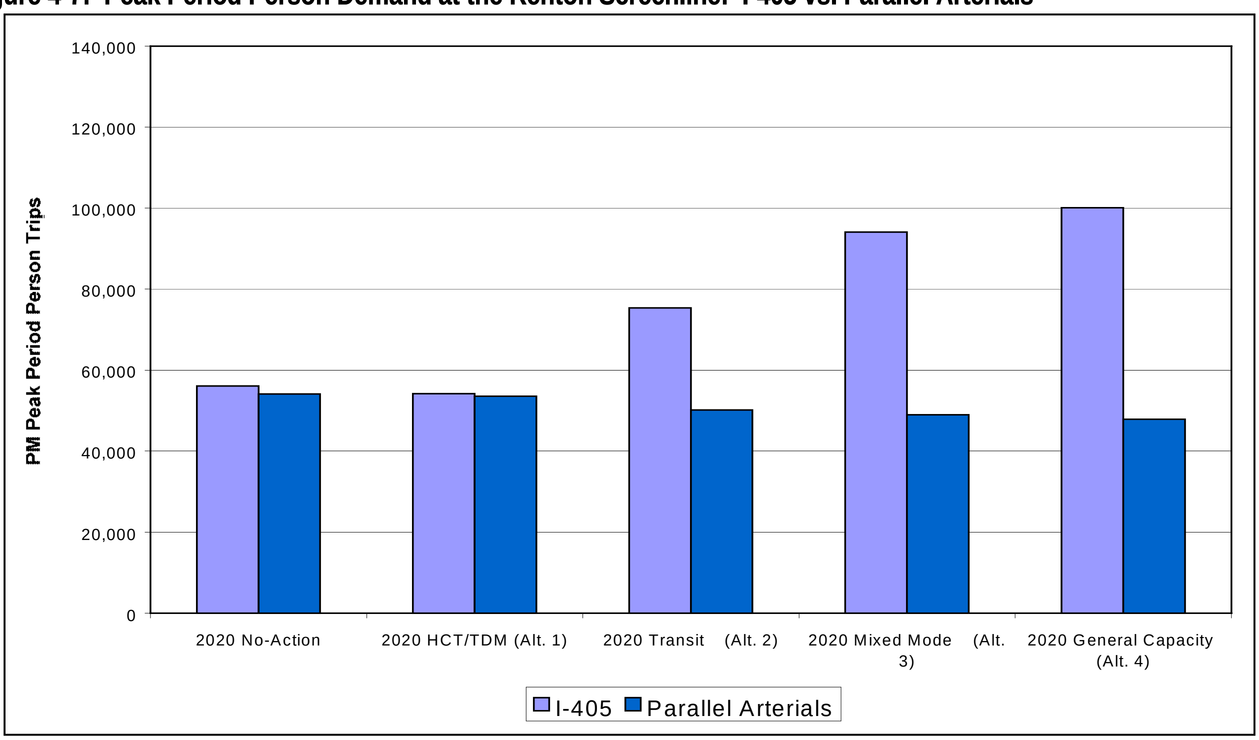
Source: PSRC Model, Parsons Brinckerhoff

Figure 4-6: Peak Period Person Demand at the Bellevue Screenline: I-405 vs. Parallel Arterials



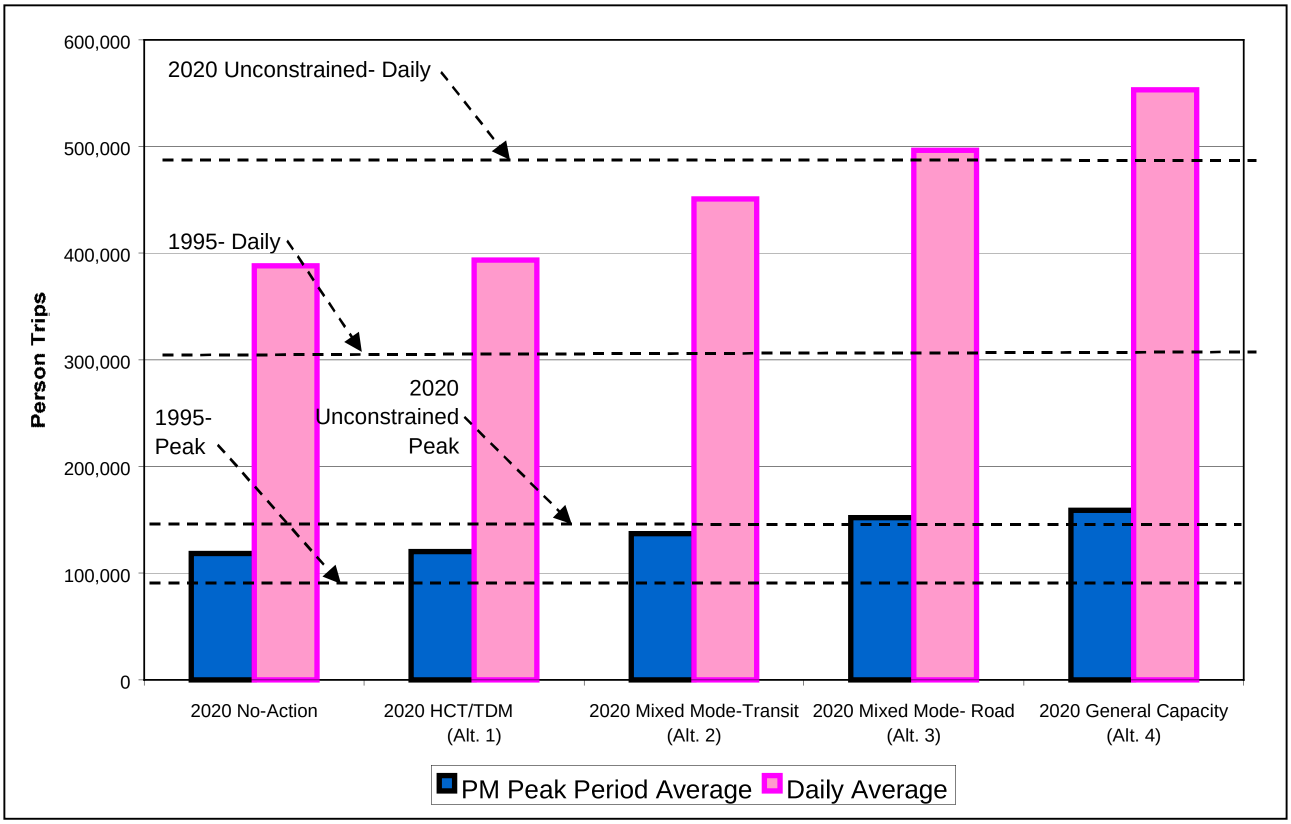
Source: PSRC Model, Parsons Brinckerhoff

Figure 4-7: Peak Period Person Demand at the Renton Screenline: I-405 vs. Parallel Arterials



Source: PSRC Model, Parsons Brinckerhoff

Figure 4-8: Person Demand Averaged Across 3 Screenlines: Peak Period vs. Daily



Source: PSRC Model, Parsons Brinckerhoff

4.2.1.1.2 Vehicle Volumes

Daily and PM Peak Period Traffic Volumes by Types of Vehicles (SOVs, HOVs, and Trucks)

PM peak period (3 hours) and daily vehicle trips were summarized at the three screenlines shown in Figure 4-1. The three screenline locations were in Bothell (at the King/Snohomish County line), in Bellevue, and in south Renton. At each screenline, vehicles included general traffic (i.e. single occupant vehicles and 2-person carpools), HOV 3+, and commercial vehicles.

The 2020 No Action demand was compared against 1995 base conditions.

On average across the three screenlines, the No Action peak vehicle demand is 21 percent higher than the 1995 base conditions. This demand increase is lower than the growth in person trips and reflects the general increase in carpooling and transit usage by 2020. A higher proportion of the growth in traffic occurs on the arterials parallel to I-405 rather than on I-405 itself. During peak periods, I-405 cannot absorb much more demand, resulting in growing spillover of demands to parallel arterials. This effect is similar to the person trip results.

Types of vehicles were also examined at each screenline. HOV (3+) vehicles increased substantially from 1995 to 2020 conditions due to general worsening of congestion and the relative travel time advantages of the HOV lanes on major freeways in the study area. HOV's comprise 3 to 4 percent of vehicles along I-405 at the Bothell screenline and up to 10 percent of vehicles in Renton. Commercial vehicles comprise around 7 percent of vehicles throughout the corridor. Commercial vehicles include service and delivery vans as well as heavy trucks. Heavy truck usage is greater at the southern portion of the corridor where freight carriers are moving to and from the large warehouse and distribution center in the Kent Valley.

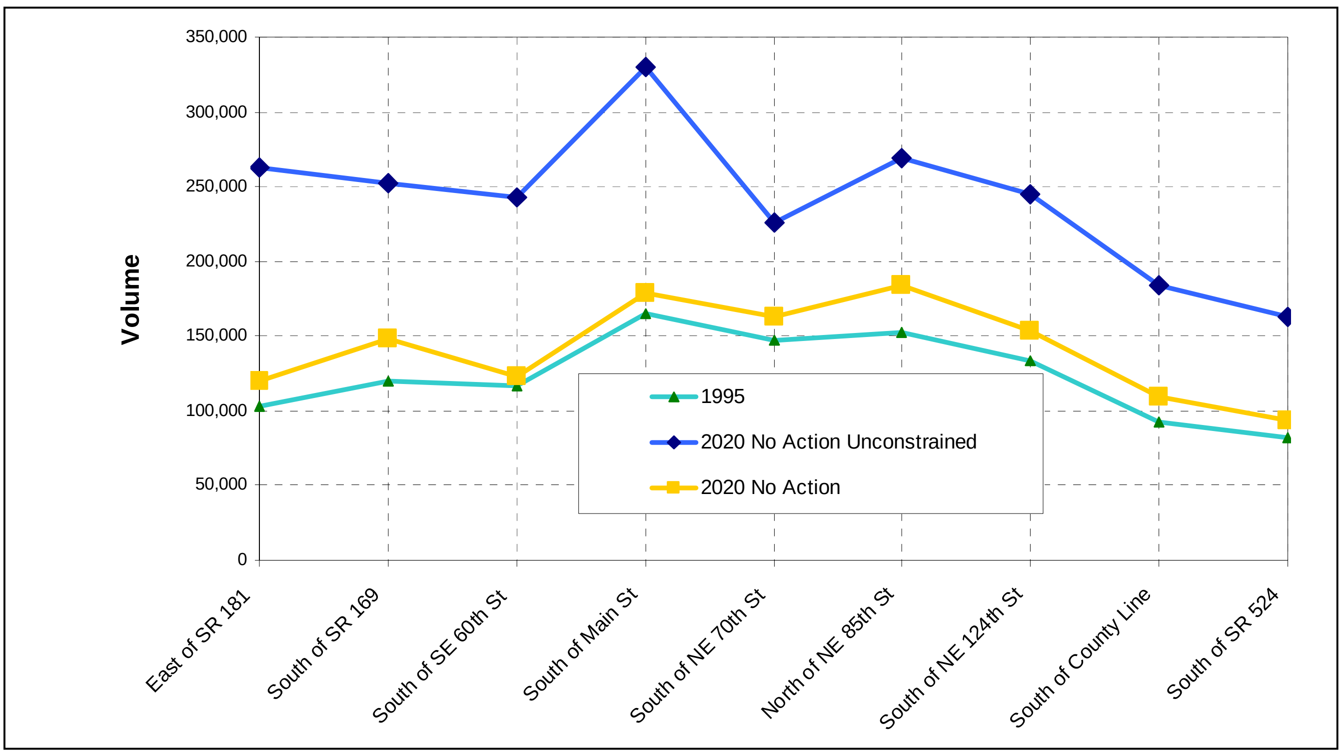
Daily Traffic Volumes by Types of Vehicles (SOVs, HOVs, and Trucks) at 3 Screenlines

Daily vehicle volumes were analyzed at the same three screenlines. The trend in daily vehicle trips for the No Action Alternative is virtually identical to the daily person trips documented previously.

Daily Traffic Volumes Along Segments of I-405

Daily traffic volumes along I-405 are shown in **Figure 4-9**. The No Action volumes are only about 10 percent higher than the 1995 volumes due to the limited spare capacity available on the existing freeway. Volumes are highest between I-90 and SR 520 (downtown Bellevue). Daily Volumes are similar in the segments south of I-90 and north of SR 520 (north to SR 522). The volumes are lower by around 20 percent to the north of SR 522 relative to the segments to the south.

Figure 4-9: I-405 Daily Traffic Volumes at Selected Locations: No Action vs. 1995



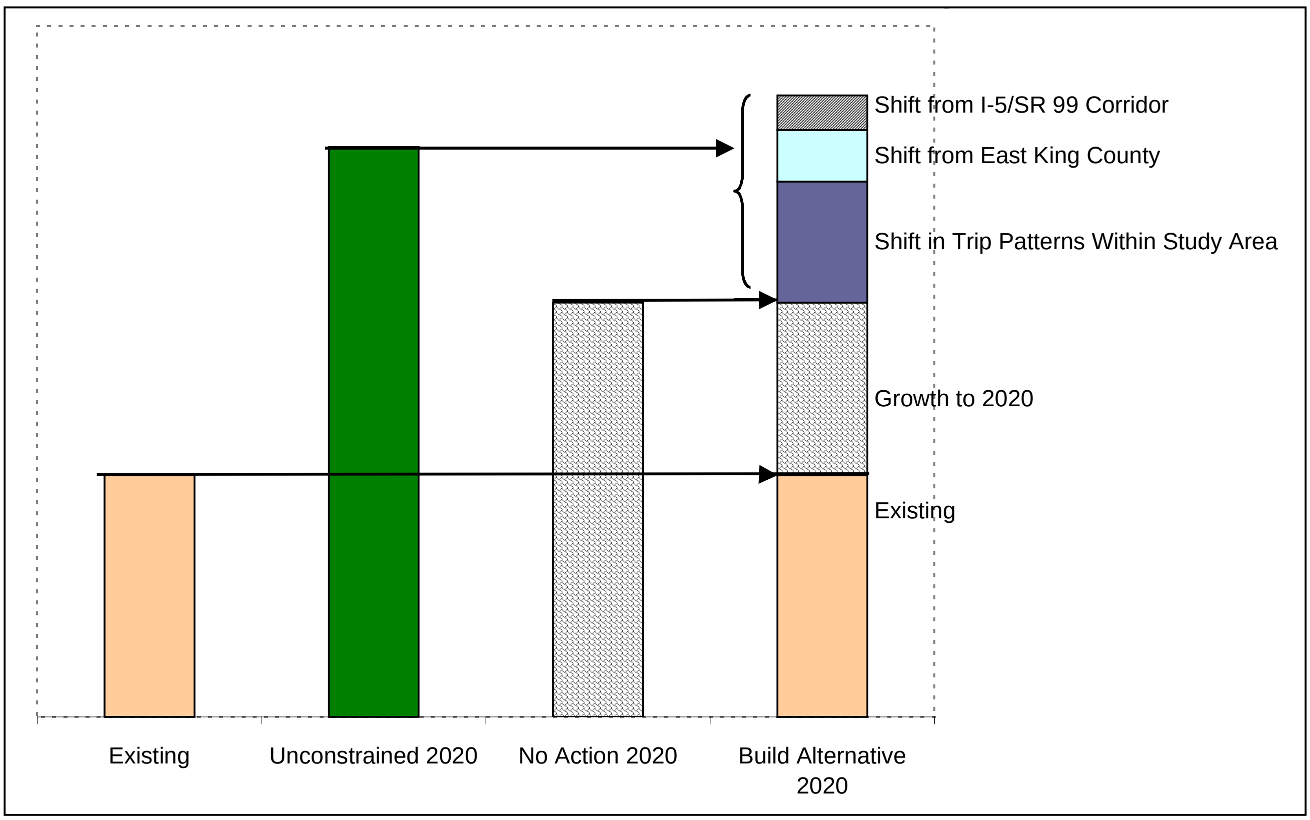
Source: PSRC Model

Daily Traffic Volume Shifts Between Facilities Along Selected Screenlines

Sources of Daily Travel Demands within the Corridor: Several of the Alternatives provide increased person capacity within the I-405 corridor. Most of the major traffic capacity is provided on I-405 itself. As a result, total vehicular and person volumes increase within the corridor, with a focus on I-405. These increases are due to two primary factors: (1) Travel demand shifts from heavily congested roadways inside and outside the study area, and (2) Changes in travel mobility within the study area that result in different trip patterns and longer trips being made. These sources are shown diagrammatically in **Figure 4-10**.

The No Action Alternative provides a baseline for comparison of travel demands between the Build Alternatives. The effects of other induced demand are expected to be minimal for the No Action Alternative. However, a test was made to determine whether the land use patterns assumed in the PSRC model would occur if no additional transportation infrastructure were provided. The *I-405 Corridor Program Draft Land Use Expertise Report* (DEA, 2001) documents the results of this analysis, which showed that the expected development patterns may be less likely to take effect under the No Action case due to inadequate transportation infrastructure. The overall effects were found to be small at the regional level.

Figure 4-10: Effects of Alternatives on Travel in Study Area



Source: Mirai Associates

4.2.1.2 Criterion: Improve Predictability of Travel Times for All Modes

This criterion is measured by analyzing the predictability of the travel time in the corridor for general traffic, HOV, transit, and freight. Nonmotorized modes were not analyzed.

4.2.1.2.1 Effects on Travel Time Predictability by Mode

Overall, the predictability of travel times under No Action would degrade and become much worse than the existing conditions. Average hours of general traffic congestion for No Action are projected to be 5.8 hours a day when freeways and arterials are combined. The existing level of traffic congestion, as I-405 and arterials are combined, is 4.5 hours a day. As the duration of traffic congestion spreads beyond the traditional peak periods, the predictability of general traffic and freight travel times would worsen.

Since some sections of the existing facilities on I-405 do not meet the current design standards, incidents are not well managed. This situation would not be improved under No Action.

The reliability of HOV and transit travel would worsen due to growing congestion in the HOV lanes. HOV and transit vehicles would also be caught in growing congestion outside of the HOV system. A regional policy change to an HOV 3+ requirement on HOV lanes will result in improved reliability for HOV 3+ vehicles. However, 2-person carpools would face unpredictable travel times, since they will be displaced from the I-405 HOV lanes.

4.2.1.3 Criterion: Provide Flexibility to Accommodate Post-2020 Travel Demands

This criterion is measured by looking at the future flexibility of the Alternatives by using the following performance measures.

- System capacity beyond 2020
- Potential for system to adapt to changing needs and conditions

4.2.1.3.1 Available Capacity at 2020

The No Action Alternative would have minimal available capacity remaining after 2020.

As previously presented, the No Action Alternative showed a 34 percent higher person demand than the 1995 base conditions, consistent with general growth in the corridor. Much of the demand occurred on parallel arterials due to limited capacity available on I-405. This Alternative accommodated lower levels of person demand than any of the Build Alternatives.

In 2020, I-405 will be highly congested. On average, traffic congestion throughout the corridor will last more than 7 hours a day and 95 percent of trips on I-405 will be involved in congestion. Traffic congestion on arterial streets will be twice as much as today's level.

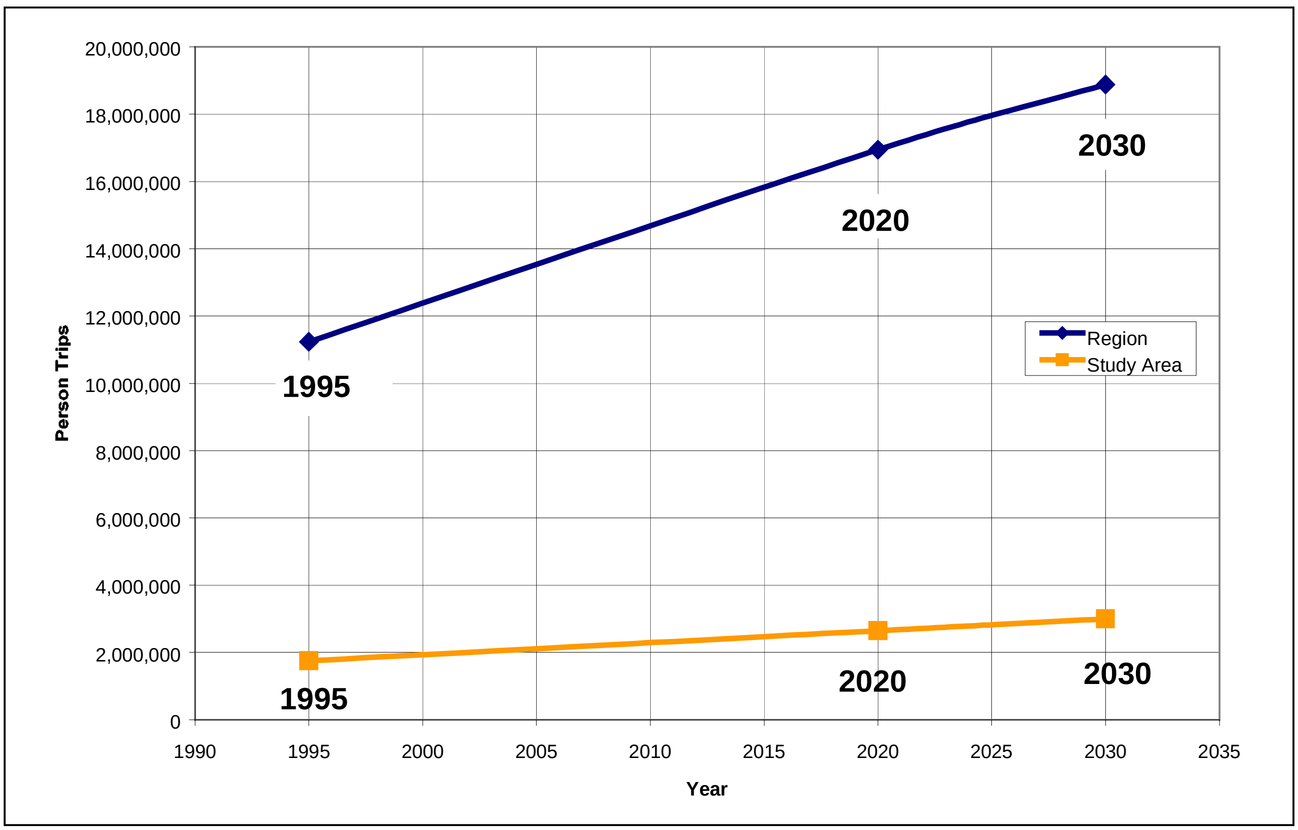
Additional travel forecasts to the year 2030 were conducted to assist in this analysis. **Figure 4-11** shows that the 2030 forecasts follow a consistent growth trend that was projected from 1995 to 2020, resulting in around a 10 percent increase in regional trips from 2020 to 2030. Within the study area, daily travel on the street system would increase from 5 to 15 percent depending upon the specific location. Along I-405, daily traffic volumes were forecasted to increase by only 5,000-10,000 vehicles per day (approximately 5 percent) for No Action conditions. This indicates that the No Action Alternative has minimal available capacity for travel growth after 2020.

By 2030, daily traffic volumes on I-405 are forecasted to increase by only 5 percent, due to the very limited capacity. Volumes on the already congested arterials would continue to increase at a faster rate than on I-405, as they carry the growing spillover traffic from I-405.

4.2.1.3.2 Potential for Adaptability

The No Action Alternative contains facilities and programs that are extensions of existing conditions. There are few unique features that would provide potential for adapting to new technologies or designs. The Alternative includes several applications of Intelligent Transportation Systems (ITS) that would continue to maximize the efficiency of the current system.

Figure 4-11: Growth in Regional Daily Person Trips- 1995 to 2030



Source: PSRC Model, Parsons Brinckerhoff

4.2.1.4 Criterion: Reduce Travel Times for All Modes Door-to-Door Compared with Current Conditions

This criterion is addressed by the following performance measures.

- General Traffic travel times between selected origins and destinations (O/D)
- HOV (3+) travel times
- Transit travel times

This travel time criterion is applied to measure the door-to-door travel time for selected origins and destination trips during the PM peak period for three types of trips: general traffic (including 2-person carpools); HOVs (carpool 3+ and vanpool), and transit.

The study selected six trips that represent a wide range of typical travels mostly using the facilities in the study area. These trips are defined as follows:

- Bellevue CBD to Federal Way/Kent
- Renton to Mill Creek
- Bellevue CBD to Edmonds/Lynnwood
- Tukwila/Sea-Tac to Redmond/Overlake
- Issaquah/Cougar Mountain to Bothell/Kenmore
- Issaquah/Cougar Mountain to Federal Way/Kent

The 2020 travel times of the six trips for the PM peak hour under the No Action Alternative are compared with the existing conditions (1995). **Table 4-1** shows the existing and No Action travel times with the general traffic and HOV (carpool (3+) and vanpool) modes. In **Table 4-2**, the transit travel times are separated with two types of access to transit service --- walk-and-ride and park-and-ride.

4.2.1.4.1 General Traffic

In the No Action Alternative, minimal new general traffic capacity is added to the transportation system. As a result, the travelers of all six trips would take much longer in 2020 than current conditions. The additional delays would be substantial. In **Table 4-1,** for example, it would take additional 23 minutes to travel from the Bellevue CBD to Federal Way/Kent. The additional travel times for other trips will be in a range of 13 to 19 minutes more than current conditions.

Overall, the 2020 travel times for the six trips would be 25 to 40 percent slower than current trip times.

4.2.1.4.2 HOVs

The 2020 travel times for HOVs for those six trips would be relatively constant during the next 20 years. As seen in **Table 4-1** the additional travel times are in the range of two to six minutes. The trip from Issaquah to Bothell/Kenmore would experience six minutes of additional travel time.

Table 4-1: General and HOV Traffic PM Peak Period Travel Time Comparisons Between Existing (1995) and 2020 No Action

	General Traffic* Travel Time (Minutes)			HOV (3+) Travel Time (Minutes)		
Trips	**1995**	**2020 No Action**	**Difference**	**1995**	**2020 No Action**	**Difference**
Bellevue CBD to Federal Way/Kent	56	79	+23	40	42	+3
Renton to Mill Creek	65	84	+19	49	51	+2
Bellevue CBD to Edmonds/Lynnwood	42	55	+13	38	36	1
Tukwila/Sea-Tac to Redmond/Overlake	49	61	+13	39	42	+3
Issaquah/Cougar Mount. to Bothell/Kenmore	46	62	+15	39	45	+6
Issaquah/Cougar Mount. to Federal Way/Kent	56	74	+19	47	51	+5

* Single occupant vehicles, 2-person carpools, trucks
Source: Puget Sound Regional Council (PSRC) Model

4.2.1.4.3 Transit

As is the case for the HOV trips, the 2020 No Action transit travel times would change little compared with the existing travel times. **Table 4-2** shows the results of the analysis. Transit travel times remain considerably higher than general traffic times for comparable trips.

For walk-and-ride trips, a few transit trips would experience one or two minutes of additional travel times and other trips would reduce transit travel times by one or two minutes. The trips between Issaquah and Bothell/Kenmore would experience greater delays.

For transit riders with park-and-ride access, the 2020 travel time changes are similar to those of the walk-and-ride access travelers. One difference between walk-and-ride and park-and-ride access is the longer travel time for the Renton to Mill Creek trip with park-and-ride access. This may be due to added delays approaching park-and-ride facilities.

Table 4-2: Transit PM Peak Period Travel Time Comparisons Between Existing (1995) and 2020 No Action

	Transit Travel Time with Walk-and-Ride Access (Minutes)			Transit Travel Time with Park-and-Ride Access (Minutes)		
Trips	**1995**	**2020 No Action**	**Difference**	**1995**	**2020 No Action**	**Difference**
Bellevue CBD to Federal Way/Kent	95	95	0	83	85	+2
Renton to Mill Creek	125	126	+1	105	112	+7
Bellevue CBD to Edmonds/Lynnwood	85	84	-1	76	73	-3
Tukwila/Sea-Tac to Redmond/Overlake	116	116	0	103	102	-1
Issaquah/Cougar Mount. to Bothell/Kenmore	108	114	+6	98	104	+6
Issaquah/Cougar Mount. to Federal Way/Kent	132	130	-2	118	119	+1

Source: PSRC Model

4.2.1.5 Criterion: Reduce the Share of Peak Period and Daily Trips by Single Occupant Vehicles

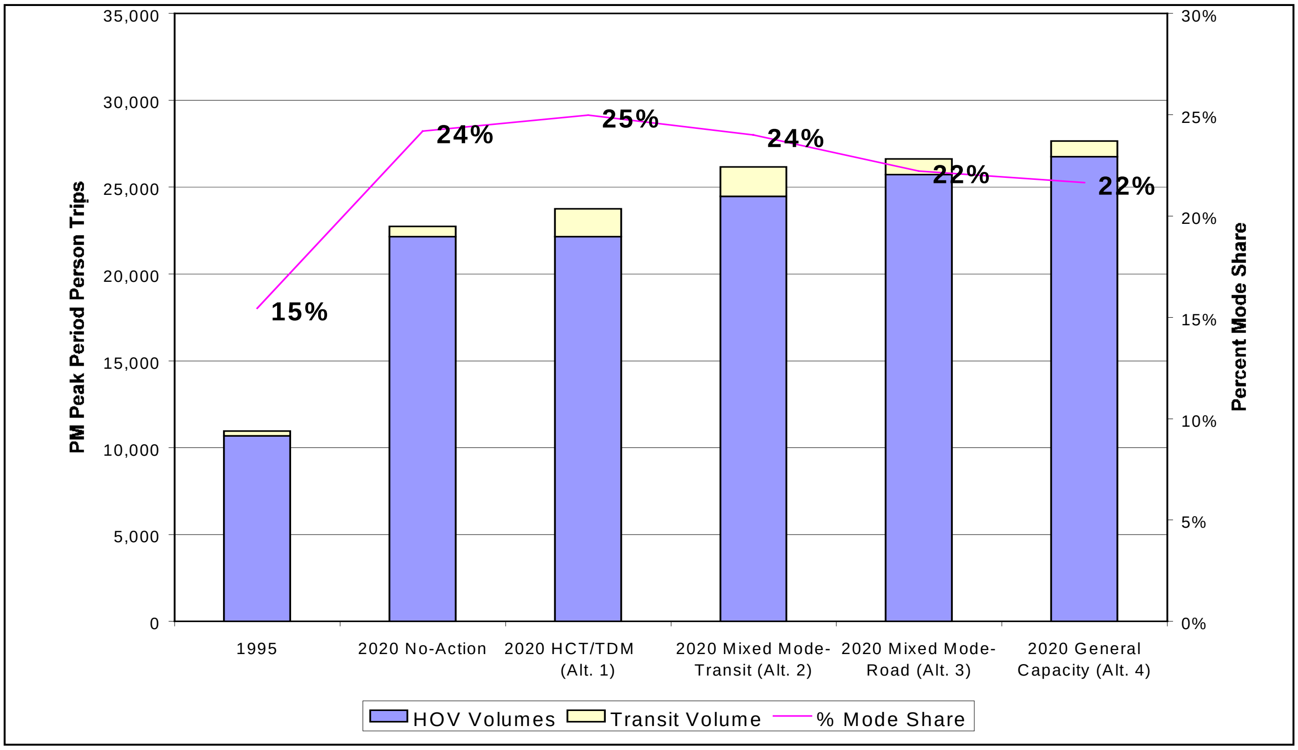
This criterion is measured by analyzing the modal shares of study area trips.

4.2.1.5.1 Modal Shares

Percentage of Peak Period Persons Choosing Modes of Travel at 3 Screenlines

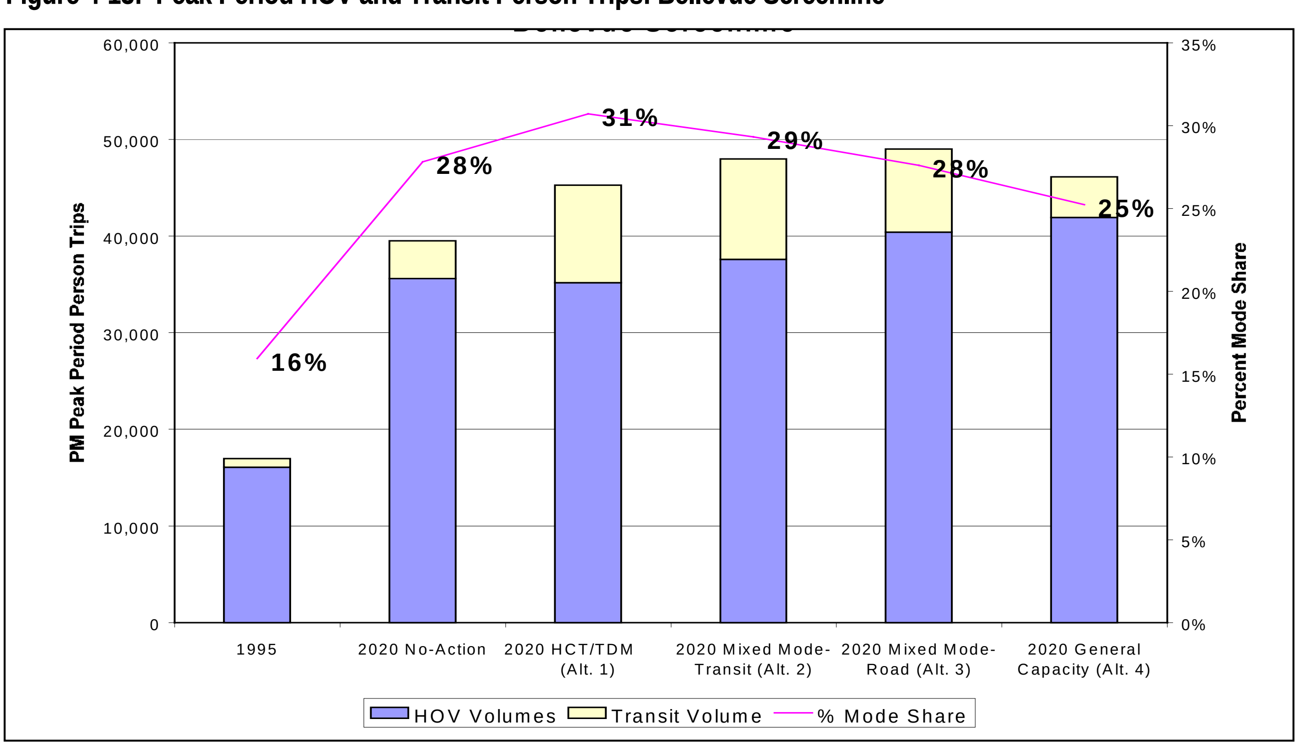
This performance measure summarizes the percentage of PM peak period persons utilizing alternative modes (HOV 3+ and transit) at three screenlines located in Bothell, Bellevue, and Renton. (Refer to Figure 4-1 for screenline locations). **Figures 4-12 through 4-14** depict the HOV and transit person trips and mode shares at the screenlines. Pedestrian and bicycle mode use was not estimated.

Figure 4-12: Peak Period HOV and Transit Person Trips: Bothell Screenline



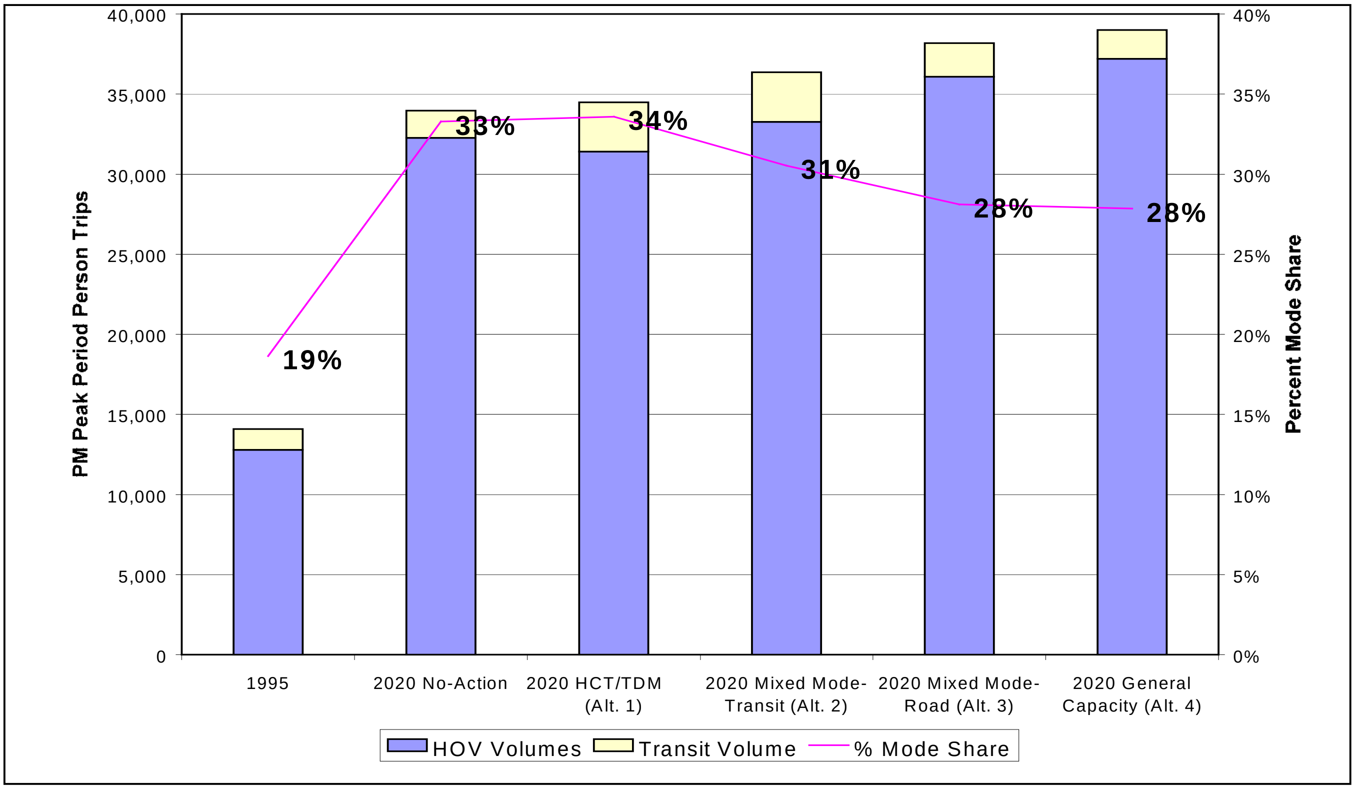
Source: PSRC Model, Mirai Associates

Figure 4-13: Peak Period HOV and Transit Person Trips: Bellevue Screenline



Source: PSRC Model, Mirai Associates

Figure 4-14: Peak Period HOV and Transit Person Trips: Renton Screenline



Source: PSRC Model, Mirai Associates

HOV (3+)

In 2020, the regional HOV occupancy policy is assumed to change from a definition of HOV 2+ to be HOV 3+ and is built into the PSRC travel forecasts used in these analyses for all HOV facilities. This means that a carpool would need to have at least 3 persons per vehicle in order to use the HOV lane system. This policy change has been built into the PSRC travel forecasts used for this analysis.

Using the HOV 3+ definition, Figures 4-12 through 4-14 indicate that there would be a considerable increase in HOV 3+ usage between 1995 and 2020. This change can be attributed to overall corridor growth and higher congestion levels that would provide incentives to form an HOV. HOV usage would range from 24 percent in Bothell to 25 percent in Bellevue to 32 percent in Renton. Along I-405 itself, HOV usage through Bothell and Bellevue would account for 30-35 percent of the total peak period person demand. In Renton, the HOV usage of I-405 would be above 40 percent.

In addition, 2-person carpools (HOV 2+) would continue to comprise from 10 to 20 percent of the total screenline person demand. Many of these carpools are expected to be for non-work purposes (e.g. shopping, recreation). Though these carpools would not be eligible to use the I-405 HOV lanes in 2020, but they could take advantage of other carpool incentives offered through the Transportation Demand Management (TDM) programs provided in the study area.

Transit

Transit usage increases are small for all three screenlines. The largest increase is at the Bellevue screenline, where peak period transit usage would increase from 1 percent to 3 percent from 1995-2020; Renton usage stays in the 2 percent range, while Bothell transit remains less than 1 percent of the PM peak period person trips.

Shares of Study Area Work Trips

This measure indicates the mode of travel chosen by workers within the study area. Most work trips occur during the peak periods and comprise around a quarter of total daily trips.
In the No Action Alternative, the mode split of daily work person trips is as follows:

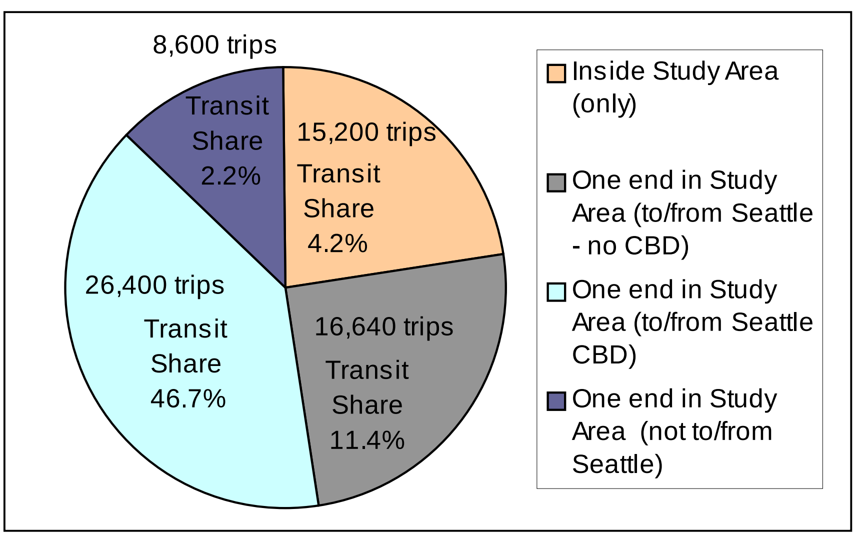
- Transit – 7 percent
- HOV (3+) - 19 percent
- Non-HOV (SOV, 2 person carpools) - 74 percent

Single-Occupant Vehicle users represent approximately 50 percent of the total work trips.

The mode shares for work-related transit and HOV trips are about four times higher than the average transit/HOV mode shares for total daily trips (ie., work plus nonwork).

Transit work trip mode shares vary significantly by the destination of the trip. As shown in **Figure 4-15**, about three quarters of all work transit trips originating within the I-405 study area have a destination that is located outside of the study area. Overall, nearly 65 percent of all transit person trips begin or end in Seattle (40% to/from downtown Seattle). The transit mode share for the Seattle-oriented trips is 21 percent (47% for downtown Seattle), while the transit mode share for work trips staying within the study area is only 4 percent.

Figure 4-15: Transit Work Trip Mode Shares by Destination - No Action



Source PSRC Model

Table 4-3 shows the transit mode shares for study area trips oriented to different activity centers within the I-405 study area. These represent trips that originate within the study area only. There is a significant difference between the transit mode shares for work vs. total trips during the day. For example, downtown Bellevue achieves a 5 percent transit mode share for total daily trips, but almost a 30 percent share for work trips. The Renton CBD is the only other activity center that shows a sizeable transit mode share for total trips.

Table 4-3: Daily Transit Trips Between I-405 Study Area and Activity Centers- No Action Alternative

Trip Location / Transit Mode Share	Total Daily Trips 1995	Total Daily Trips 2020 No Action	Daily Work Trips 1995	Daily Work Trips 2020 No Action
Bellevue CBD to/from Study Area	1,540	17,470	1,070	11,890
Transit Mode Share	1.1%	5.4%	5.3%	27.2%
Bothell CBD to/from Study Area	70	370	50	290
Transit Mode Share	0.1%	0.4%	0.8%	1.9%
Kirkland CBD to/from Study Area	100	510	60	290
Transit Mode Share	0.1%	0.2%	0.3%	0.9%
Overlake CBD to/from Study Area	160	980	100	610
Transit Mode Share	0.1%	0.3%	0.3%	1.1%
Redmond CBD to/from Study Area	40	110	20	70
Transit Mode Share	0.2%	0.4%	1.8%	3.3%
Renton CBD to/from Study Area	230	1,280	150	850
Transit Mode Share	0.5%	2.3%	2.7%	11.5%
Region-wide	279,850	648,760	161,380	349,970
Transit Mode Share	2.8%	4.5%	7.7%	11.2%

Source: PSRC Model (2000)

4.2.1.5.2 Transit Riders

PM Peak Period Transit Riders Along Key Segments

High Capacity Transit is not included in the No Action Alternative.

4.2.1.6 Criterion: Provide Effective Connections to Regional and Local Transportation Systems

An important criteria adopted in the I-405 Corridor Program is to provide effective connections to regional and local transportation systems.

There are two measures under this criteria: Compatibility of the improvement package with the regional transportation systems, and Compatibility with local transportation systems.

4.2.1.6.1 Compatibility with Regional Systems

For this analysis, the regional transportation system means the regional freeway network. I-405 is connected at the following interchanges to other regional facilities:

- I-5 in the vicinity of Sea-Tac
- SR 167 in the vicinity of Renton
- I-90 through south Bellevue
- SR 520 in north Bellevue
- SR 522 in Bothell
- I-5 in the vicinity of Lynnwood

This criterion also evaluates how well the regional transportation system supports the urban centers designated by the Puget Sound Regional Council. The designated urban centers in or near the study area include:

- Kent downtown area
- Sea-Tac central business district
- Tukwila South Center business area
- Renton downtown area
- Bellevue central business district
- Redmond downtown area
- Bothell Canyon Park
- Lynnwood business area

While the existing I-405 is connected to the regional system, there are several major problems with HOV connections:

- The HOV lanes on I-405 are not directly connected to the regional HOV lane network at several locations.
- Some direct HOV lane connections are missing at the I-5 / I-405 interchange in the Tukwila / SeaTac area.
- No direct HOV lane connections with SR 167 HOV lanes in the Renton area.
- Several direct HOV lane connections are missing at the I-90 / I-405 interchange.
- No direct HOV lane connections are provided at the I-405 / SR 520 interchange.
- SR 522 in Bothell does not have HOV lanes.

- No direct HOV lane connections are provided at the I-5/I-405 interchange in Lynwood.

Sound Transit has a program in place to improve HOV access to urban centers in the study area. Three HOV direct access locations have been planned: the Renton urban center, the Bellevue urban center and the Kirkland Totem Lake business area.

For the general-purpose traffic, several connections between I-405 and the regional network have been identified with serious problems.

- Severe traffic congestion exists at the I-405/SR 167 interchange due to the lack of ramp capacity. This severely restricts truck movement to and from the major warehousing area in the Kent Valley.
- Some ramps are highly congested during peak periods at the I-405/I-90 interchange.
- At the I-405/SR 520 interchange, the northbound-to-eastbound movement is congested throughout day; the problem may be the lack of capacity on SR 520.
- The connection to I-5 from I-405 in Lynwood area is severely congested, particularly in the northbound direction on I-405 in the PM peak period.

In summary, the I-405 facilities today are not effectively connected with the regional transportation systems for both general-purpose and HOV traffic.

The No Action Alternative assumes that the existing conditions of the HOV lane system would continue into the future. This means that the I-405 HOV lanes would not be directly connected with the regional HOV system using direct freeway-to-freeway HOV ramps. Sound Transit would complete the planned direct HOV access project programs: the Renton HOV access, Bellevue HOV access and Kirkland Totem Lake access projects.

There may be modest general-purpose traffic improvements to address the ramp capacity problems at the I-405/SR 167 interchange. The Trans-Lake Washington study would be completed and may recommend that HCT/transit capacity and general-purpose capacity be expanded on SR 520 including improved connections with I-405.

Since the No Action Alternative is the same as the existing conditions with regard to the HOV connectivity, the compatibility with the regional HOV system would continue to be poor. Since this alternative would not improve the current serious connectivity problems for general-purpose traffic, compatibility with the regional transportation system would not be any better than today. Given that the travel demands within the I-405 corridor in 2020 increase substantially, the compatibility problem for general-purpose (GP) traffic would degrade and the conditions would become worse. This includes freight movement. The No Action Alternative does not improve freight mobility as do most of the other Alternatives.

4.2.1.6.2 Compatibility with Local Systems

The series of interchanges placed along I-405, are designed to provide access to local transportation networks. The compatibility with local transportation systems was evaluated using the following questions:

- Would the capacity of the access ramps at the I-405 interchanges be adequate to accommodate the travel demands from the arterials that connect with I-405?

- Would the capacity of the arterials connecting with I-405 be adequate to accommodate the travel demands from I-405?
- Would there be any major obstacles that would prevent vehicles from flowing smoothly between I-405 and the local transportation systems?
- Would the arterial improvements in the Alternatives be compatible with the local transportation systems?
- Would the I-405 HOV facilities be connected with arterial HOV facilities?

Problems related to the compatibility with local transportation systems exist in the I-405 corridor today. In some cases, local arterials in the vicinity of the I-405 interchanges are highly congested because the I-405 ramp and mainline capacity are not adequately provided. In other cases, arterial capacity in the vicinity of the I-405 interchange is not adequately provided, resulting in traffic backups, which are often interfering with I-405 mainline traffic flows.

The compatibility problem between I-405 and local transportation systems would worsen if no action is taken within the I-405 corridor. The locations where the compatibility problems do not exist today would experience the problem in the next two decades. Those areas where the problems exist today would get worse.

Many of the arterial improvement projects in the local plans will not be implemented under No Action. Since the local transportation plans are developed with a system-wide perspective, not implementing those arterial projects would create incompatibility problems with the local transportation systems.

■

4.2.2 Objective - Reduce Congestion

Traffic congestion along I-405 is widespread during the morning and afternoon peak periods and has spread to surrounding time periods. The use of the measure "hours of congestion" examines the number of vehicles on a road compared to available capacity, hour-by-hour. The hours of congestion criterion is defined as the period of time when vehicles move less than 45 mph on a freeway and less than 25 mph on an arterial route.

4.2.2.1 Criterion: Reduce Congestion on Study Area Freeways and Arterials Below Current Levels

This criterion is addressed by examining the following performance measures:

1) Hours of Traffic Congestion

- Hours of congestion in each segment of I-405 and arterial segments in a typical day
- Hours of congestion aggregated within the study area by freeway and arterial functional classification

2) Vehicles Miles and Hours of Travel

- Study area and region-wide daily Vehicles Miles of Travel

- Study area and regional-wide daily Vehicle Hours of Travel

4.2.2.1.1 Hours of Traffic Congestion

Hours of Congestion in Each Segment of I-405 and Within the Study Area

Hours of congestion for the No Action Alternative for 2020 are compared with the existing conditions. **Table 4-4** estimates hours of congestion for existing and No Action conditions for eight segments on I-405. The average hours of congestion for I-405, for other freeways and arterials in the study area, and for all facilities combined are also shown.

Hours of congestion on five out of the eight segments on I-405 would worsen under No Action, compared with the existing conditions. The extended hours of traffic congestion for those segments are in a range of 1 to 4 hours per direction.

Since No Action assumes that certain programmed improvements by the state and local jurisdictions would be implemented, hours of congestion would improve in some sections of I-405. Travelers in the section of I-405 from SR 520 to NE 124th Street would experience the same hours of congestion under No Action as they are today. There would be a slight improvement in hours of congestion in the section of I-405 from I-90 to SR 520.

When a segment is congested more than 10 hours a day, such a condition can be viewed as having a serious traffic problem. Three out of eight sections would operate with more than 10 hours of congestion in 2020. The I-405 segments having more than 10 hours of congestion under No Action are listed below:

- I-5 to SR167
- SR 167 to NE Park Drive
- NE Park Drive to I-90

On average among all segments of I-405, No Action would operate slightly worse than existing conditions. Hours of congestion on other freeways in the study area would extend to five hours from the current three hours; on arterials hours would extend to five hours from the current three hours today. When all facilities are combined (I-405, other freeways and arterials), the system-wide hours of congestion would worsen to five hours from four today.

Table 4-4: Hours of Traffic Congestion by I-405 Segments for Existing and No Action Alternatives

I-405 Segment	1999 Existing (hours)	No Action (hours)	Difference (No Action-1999)
I-5 to SR 167	12	13	+1
SR 167 to NE Park Dr.	10	14	+4
NE Park Dr. to I-90	10	11	+1
I-90 to SR 520	9	8	-1
SR 520 to NE 85th Street	5	5	0
NE 85th Street to NE 124th Street	5	9	0
NE 124th Street to SR 522	4	8	+4
SR 522 to I-5	5	6	+1
Average of I-405	**7**	**7**	**0**
Average of Other Freeways	**3**	**5**	**+2**
Average of Arterials	**3**	**5**	**+2**
Average of All Facilities	**4**	**5**	**+1**

Source: PSRC Model, Mirai Associates

4.2.2.1.2 Vehicle Miles and Hours of Travel

Study Area and Region-wide Daily Vehicles Miles, Hours of Travel, and Speeds

Vehicle miles of travel (VMT) is a measure of total vehicle trips multiplied by the length of the trip (in miles). VMT is summarized at the study area and regional level and portrays overall changes in travel activity that may occur in response to an alternative. Vehicle hours of travel (VHT) is a similar measure, but captures the quality of travel in terms of travel time. Appendix H provides additional regional VMT and VHT information and comparisons with the Build Alternatives.

Table 4-5 summarizes the changes in study area and regional daily VMT and VHT for the No Action Alternative, compared to 1995 base conditions. Within the I-405 study area and regionally, the growth in VHT would increase at a much higher rate than growth in VMT. This result correlates with the degradation of congestion levels that are expected to occur in the 2020 No Action Alternative. The VMT changes were relatively consistent during the peak and off-peak periods. However, the increase in VHT was found to be much higher (+160% study area; +97% region) during the PM peak period in comparison to other times during the day.

Table 4-5: VMT and VHT for Study Area and Region-wide – No Action

	VMT (Daily)		VHT (Daily)	
Alternative	**Study Area (trips within)**	**Region-wide**	**Study Area (trips within)**	**Region-wide**
1995	16,346,000	69,412,000	586,000	2,295,000
2020 No Action	22,510,000	100,571,000	1,156,000	3,948,000
Change vs. 1995 (%)	37.7%	44.9%	97.3%	72.0%

Source: PSRC Model

Average speeds, shown in **Table 4-6** also portray the deterioration of travel conditions between 1995 and 2020. The average speed is calculated by dividing VMT by VHT. The change in speeds is most apparent in the PM Peak Period.

Table 4-6: Average Travel Speeds – No Action

	Average Speeds in MPH (AM Peak Period/PM Peak Period/Daily)		
Alternative	**I-405**	**Study Area (Trips Within)**	**Region-wide**
1995	39/33/37	30/24/28	31/28/30
2020 No Action	34/25/31	26/13/19	29/20/25

Source: PSRC Model

4.2.2.1.2 Concurrency Impacts

The local jurisdictions in the I-405 study area are facing serious traffic concurrency problems. If those issues are not managed effectively and addressed adequately by 2020, it is possible that the projected growth might not be realized. The existing concurrency problems in most of the local jurisdictions would be exacerbated in the future with the No Action Alternative. Traffic congestion on I-405 and arterials is expected to increase. The analysis results show virtually every jurisdiction within the study area would reach or exceed concurrency levels by 2020. The *I-405 Corridor Program Draft Land Use Expertise Report* (DEA, 2001) shows that the No Action Alternative may force some land use growth to occur outside of the I-405 study area, partially due to restricted transportation accessibility.

■

4.2.3 Objective – Improve Safety

4.2.3.1 Improve the Safety for All Modes Above Current Levels

This criterion is addressed by examining the following performance measures for safety issues:

- Potential for traffic accident reduction along high accident locations
- System level effects on accidents
- Potential for improving safety for transit vehicles
- Potential for reducing conflicts between vehicles, pedestrians and bikes

4.2.3.1.1 Potential for Traffic Accident Reduction Along High Accident Locations

This performance measure examines identified High Accident Locations (HAL's) documented within the study area by WSDOT and local agencies. **Table 4-7** high accident locations for I-405, I-5/I-90, and State Routes within the study area. In general, there were a total of 60 HAL's identified. Safety improvements in the No Action Alternative would improve nine of the identified HAL's.

Table 4-7: Safety Improvements for Freeways and State Routes - No Action Alternative

Facility	HAL Totals	Safety Improvement Totals No Action	
		Total	%
I-405	30	3	10%
I-90	3	0	0%
State Routes	27	6	22%
Total	**60**	**9**	**15%**

Source: Mirai Associates

Table 4-8 summarizes a sampling of the HAL's in unincorporated in King County and city streets within the study area. Each jurisdiction had a separate approach in identifying HAL's, and, therefore, unincorporated King County and city streets were judged separately than the freeways and state routes, which were accounted for and analyzed by WSDOT. In general, there were a total of 47 HAL's identified. The No Action Alternative would improve three of the identified HAL's.

Table 4-8: Safety Improvements on Local Jurisdiction Streets for No Action Alternative

Facility	HAL Totals	Safety Improvement Totals No Action	
		Total	%
Unincorporated King County and City Streets	47	3	6%

Source: Mirai Associates

4.2.3.1.2 System-Level Effects on Accidents

An analysis of system-level accident effects was conducted within the I-405 study area. The No Action Alternative provides a baseline for comparison of the Build Alternatives. The analysis used the following sources of data.

Vehicle travel by facility type: The travel forecasting model produces daily estimates of Vehicle Miles of Travel (VMT) by facility type within the study area. Daily VMT is multiplied by 365 to derive annual VMT used to calculate accidents. The following **Table 4-9** provides estimates for 1999 (current conditions) and 2020 No Action conditions.

Table 4-9: VMT by Facility Type in the Study Area – No Action

Facility	1999 VMT (Millions)	2020 No Action VMT (Millions)	Percent Designed to Standard
I-405	3.84	3.95 (+ 3%)**	60%
Other Freeways	4.52	5.28 (+17%)**	60%
Arterials*	6.03	8.89 (+47%)**	Not Applicable
Total	**14.39**	**18.12 (+26%)****	

* Principal and minor arterials within the study area
**(percent change 1999-2020)
Source: PSRC Model, Mirai Associates

Design Standards: The analysis of current design conditions along I-405 indicates that approximately 60 percent of the corridor is designed 'to standard'. A similar percentage was applied to other freeways (e.g. SR 520, I-90, SR 167) within the study area.

Percent Congested: The analysis of study area congestion produced estimates of what proportion of the vehicle miles of travel on each facility would be congested on a daily basis. The following results in **Table 4-10** apply to current and No Action conditions.

Table 4-10: Congestion in Study Area – No Action Alternative

Facility	1999 % VMT Congested	2020 No Action % VMT Congested
I-405	94%	94%
Other Freeways	67%	71%
Arterials	56%	63%

Source: PSRC, Mirai Associates

Using these data, an estimate of the number of annual study area accidents was made. The number accidents within each category are expected to increase by around 40 percent between 1999 and 2020. These increases are higher than the rate of overall VMT growth (**Table 4-11**), but reflect the forecasts showing higher VMT growth occurring on Arterials that have higher accident rates. Similarly, the average accident rates are also estimated to increase by 2020.

Table 4-11: Study Area Accidents in 1999 and No Action 2020

Alternative	Total Accidents (rate)	Injury Accidents (rate)	Fatal Accidents (rate)
1999	10,060 (1.92)	5,910 (1.12)	40 (0.76)
No Action (2020)	13,900 (2.10)	8,340 (1.26)	56 (0.84)

Rate: per million VMT; Fatal per 100 million VMT
Source: PSRC Model, Mirai Associates

4.2.3.1.3 Potential for Improving Transit Vehicle Safety

Transit vehicle and patron safety is affected by the degree of separation between modes and the provision of updated transit facilities. The No Action Alternative includes few improvements that would affect transit safety. Transit service will continue to operate within mixed-mode environments within most of the study area. However, the completion of the core HOV system and committed HOV direct access projects and transit center projects will help to separate transit vehicles and patrons from traffic conflicts.

4.2.3.1.4 Potential for Reducing Conflicts Between Vehicles, Pedestrians and Bikes

This performance measure focuses on potential safety hazard locations for nonmotorized users crossing over I-405, recognizing that there are many other nonmotorized safety concerns within the overall study area. There were several potential High Accident Locations identified by three different situations: 1) no sidewalk and no paved shoulder; 2) no sidewalk with paved shoulder; and 3) no bike lane and no shoulder. **Table 4-12** summarizes the total number of safety improvements for the No Action Alternative for these nonmotorized locations. Using this methodology, there were a total of 17 HAL's identified. The No Action Alternative would not improve any of the identified HAL's. However, several nonmotorized improvements (e.g. sidewalks, bicycle lanes) would be made as part of the committed arterial projects included in this alternative.

Table 4-12: Nonmotorized Safety Hazard Locations - No Action Alternative

Shoulder Type	HAL Location Totals	Safety Improvement Totals	
		No Action	
		Total	%
No Sidewalk and No Paved Shoulder	6	0	0%
No Sidewalk with Paved Shoulder	2	0	0%
No Bike Lane and No Shoulder	9	0	0%
Total	17	0	0%

Source: Mirai Associates

4.2.4 Construction Impacts

The No Action Alternative involves no additional construction beyond what is planned and committed within the corridor. Beside the usual and customary detours and other construction mitigation set for these projects, no additional traffic impacts are expected.

4.3 ALTERNATIVE 1

This alternative emphasizes reliance on high-capacity transit (HCT) within the study area and substantial expansion of bus transit service. It also minimizes addition of new impervious surface from general-purpose transportation improvements by placing emphasis on non-physical mobility solutions and transportation demand management (TDM) strategies. Transportation demand strategies are emphasized in this alternative, along with consideration of regional pricing strategies in the I-405 corridor. Alternative 1 includes a physically separated, fixed-guideway HCT system, probably using some form of rail technology. Transit service would be increased up to 100 percent. I-405 improvements would be limited to minor actions aimed at improving safety and key congestion "hotspots". Minimal improvements would be made to arterials.

4.3.1 Objective - Improve Mobility

4.3.1.1 Criterion: Serve as Much of the 2020 Peak Period Travel Demand Within the Corridor as Possible

This criterion is addressed by examining the following performance measures:

1) Person Volumes

- PM peak period person volumes by mode across 3 screenlines
- Daily person volumes by mode across 3 screenlines compared to unconstrained assignments

2) Vehicle Volumes

- PM peak period traffic volumes by types of vehicles (SOVs, HOVs, buses and trucks) at 3 screenlines
- Daily traffic volumes by types of vehicles (SOVs, HOVs, buses and trucks) at 3 screenlines
- Daily traffic volumes along segments of I-405
- Daily traffic volume shifts between facilities along selected screenlines

Daily demand values are described to place the peak period results into context with the entire day within the corridor.

4.3.1.1.1 Person Volumes

PM Peak Period Person Volumes by Mode Across 3 Screenlines

PM peak period (3 hours) travel demand was summarized as the number of persons passing through the study area at three screenline locations, as described in the No Action Alternative (Figure 4-1). The Alternative 1 demand was compared against two benchmarks: No Action conditions and a 2020 'unconstrained' forecast. Appendix H presents additional information on demand at screenlines.

On average across the three screenlines, the peak person demand is virtually unchanged from No Action conditions. Most of the change in demand occurs between modes of use, as described more completely under the criterion "Reduce Share of SOV Travel" in a later section. In summary, there is a net increase in transit and carpool person trips combined with a reduction in non carpool person volumes along I-405. There was minimal change in demands on parallel arterials. This effect is shown in Figures 4-2 through 4-7.

The comparison of Alternative 1 to unconstrained demand is the same as for the No Action Alternative. The trend in daily person trips for Alternative 1 is similar to the No Action Alternative.

4.3.1.1.2 Vehicle Volumes

Daily and PM Peak Period Traffic Volumes by Types of Vehicles (SOVs, HOVs, and Trucks)

PM Peak period (3 hours) vehicle travel demand was summarized at three screenline locations, as described in the No Action Alternative. The Alternative 1 volumes were compared against No Action conditions.

On average across the three screenlines, the peak vehicle demand is virtually unchanged from No Action conditions. The trend in daily vehicle trips for Alternative 1 is similar to the No Action Alternative.

Daily Traffic Volumes Along Segments of I-405

Daily traffic volumes along I-405 in Alternative 1 are virtually unchanged from the No Action volumes. This is due to the very limited capacity improvements included with this Alternative and the very small shift in daily traffic volumes caused by the added transit services and facilities.

Daily Traffic Volume Shifts Between Facilities Along Selected Screenlines

Alternative 1 travel patterns are very similar to the No Action conditions, with no shifts between facilities or other induced travel effects.

4.3.1.2 Criterion: Improve Predictability of Travel Times for All Modes

This criterion is measured by analyzing the predictability of the travel time in the corridor for general traffic, HOV, transit, and freight. Nonmotorized modes were not analyzed.

4.3.1.2.1 Effects on Travel Time Reliability by Mode

The travel time predictability for general traffic would be slightly better than No Action. However, the situation would be worse than existing conditions. Average hours of traffic congestion for Alternative 1 are projected to be similar to the No Action, 5.8 hours a day when freeways and arterials are combined. This compares to the current level of 4.5 hours a day. As the duration of traffic congestion spreads beyond the traditional peak periods, the predictability of general traffic and freight travel times would worsen.

The improvements to accident and congestion "hotspots" along I-405 would help reduce delays due to incidents. The reliability would remain worse than existing conditions due to higher levels and duration of congestion.

HOV conditions would be similar to No Action.

Transit trip reliability would be greatly improved. A High Capacity Transit (HCT)fixed guideway system would operate on an exclusive right-of-way. This situation would provide high levels of travel time predictability for the users of the HCT system. Construction on I-405 is not extensive under this alternative, which would have minimum traffic flow disruptions. Construction of the HCT would not significantly impact I-405 traffic operation.

4.3.1.3 Criterion: Provide Flexibility to Accommodate Post-2020 Travel Demands

This criterion is measured by looking at the future flexibility of the Alternatives using the following:

- Available capacity at 2020
- Potential for adaptability

4.3.1.3.1 Available Capacity at 2020

Alternative 1 would have minimal available capacity remaining after 2020.

As previously presented, Alternative 1 showed person demand similar to No Action within the corridor. This alternative accommodated the second lowest level of person demand than any of the Build Alternatives.

The transit element of Alternative 1 would have substantial capacity to serve additional persons after 2020. **Table 4-13** shows that, in 2020, the peak demand on the fixed-guideway facility would operate at about 25 percent of the new capacity. The fixed-guideway system can easily respond to increased demand by adding more cars. Such capacity would need to be matched with future transit demand in the corridor.

Table 4-13: High Capacity Transit Demand and Capacity in 2020- Alternative 1

	Peak Hour/Direction	
	Bothell/Renton*	**Bellevue***
Capacity Supplied	1,875	9,375
Demand	420-440	2,610
Maximum HCT Capacity	15,000	15,000

*Measured at 3 screenline locations within the I-405 corridor
Source: PSRC Model

In contrast, I-405 and the arterial system would remain highly congested as in the No Action Alternative. By 2030, daily traffic volumes within the study area would be very similar to the No Action condition, with very limited available capacity for further person volume growth within the corridor. Volumes on already congested arterials continued to increase in the forecasts. This alternative accommodates the second lowest number of persons of the Build Alternatives.

4.3.1.3.2 Potential for Adaptability

Alternative 1 contains a fixed-guideway transit system that offers several opportunities for expansion and modification as demand and technology change.

The I-405 and arterial elements would provide limited opportunities for further expansion unless additional capacity was incorporated into the facility design. The alternative includes several applications of Intelligent Transportation Systems (ITS) that would continue to maximize the efficiency of the current system.

4.3.1.4 Criterion: Reduce Travel Times for All Modes Door-to-Door Compared with Current Conditions

This criterion is addressed by the following performance measures.

- General Traffic travel times
- HOV travel times
- Transit Travel Times

The door-to-door travel times for seven typical trips under Alternative 1 are compared with the No Action conditions. **Table 4-14** shows the travel times under Alternative 1 for the general-purpose traffic and HOV (carpools 3+ and vanpools) modes. **Table 4-15** shows the Alternative 1 transit travel times with two types of access to transit service --- walk-and-ride and park-and-ride.

4.3.1.4.1 General-purpose Traffic

The travel times for general-purpose travel under Alternative 1 would the same as the No Action Alternative, as shown in **Table 4-14**.

4.3.1.4.2 HOVs

The travel times for HOV 3+ under Alternative 1 conditions would not change considerably compared to the No Action. There may be one or two minutes of travel time reduction for certain trips.

Table 4-14: General and HOV Traffic PM Peak Period Travel Time Comparisons Between 2020 No Action and Alternative 1

Trips	General Traffic* Travel Time (Minutes)			HOV 3+ Travel Time (Minutes)		
	No Action	Alt. 1	Difference	No Action	Alt. 1	Difference
Bellevue CBD to Federal Way/Kent	79	79	0	42	41	-1
Renton to Mill Creek	84	84	0	51	50	-1
Bellevue CBD to Edmonds/Lynnwood	55	55	0	36	36	0
Tukwila/Sea-Tac to Redmond/Overlake	61	61	0	42	42	0
Issaquah/Cougar Mount. to Bothell/Kenmore	62	62	0	45	45	0
Issaquah/Cougar Mount. to Federal Way/Kent	74	74	0	51	50	-1

* Single occupant vehicles, 2-person carpools, trucks
Source: PSRC Model

4.3.1.4.3 Transit

Alternative 1 would improve transit travel times considerably compared to the No Action.

As shown in **Table 4-15,** the transit travel time reductions for the six trips are in the range of 3 to 30 minutes for walk-and-ride access, and from 5 to 24 minutes for park-and-ride access. The largest travel time change from No Action would be for the trip from Tukwila/SeaTac to Redmond/Overlake with a 30-minute travel time reduction for walk-and-ride access. From Renton to Mill Creek, the transit travel times would be shortened by 27 minutes and 22 minutes, with walk-and-ride and park-and-ride access, respectively. The transit trip from the Bellevue CBD to Edmonds/Lynnwood would have a relatively small improvement in travel time from six to seven minutes.

Most of the travel time improvements are due to reductions in in-vehicle transit times. Walk access times also decrease due to more transit routes and more frequent service.

Table 4-15: Transit PM Peak Travel Time Comparisons Between 2020 No Action and Alternative 1

Trips	Transit Travel Time with Walk-and-Ride Access (Minutes)			Transit Travel Time with Park-and-Ride Access (Minutes)		
	No Action	Alt. 1	Difference	No Action	Alt. 1	Difference
Bellevue CBD to Federal Way/Kent	95	77	-17	85	69	-16
Renton to Mill Creek	126	99	-27	112	90	-22
Bellevue CBD to Edmonds/Lynnwood	84	77	-7	73	67	-6
Tukwila/Sea-Tac to Redmond/Overlake	116	86	-30	102	78	-24
Issaquah/Cougar Mount. to Bothell/Kenmore	114	100	-14	104	93	-11
Issaquah/Cougar Mount. to Federal Way/Kent	130	108	-22	119	101	-18

Source: PSRC Model

4.3.1.5 Criterion: Reduce the Share of Peak Period and Daily Trips by Single Occupant Vehicles

This criterion is measured by analyzing the following performance measures:

- Modal Shares
- Transit Riders

4.3.1.5.1 Modal Shares

<u>Percentage of Peak Period Persons Choosing Modes of Travel at 3 Screenlines</u>

This performance measure summarizes the percentage of PM peak period persons using alternative modes (HOV 3+ and transit) at all three screenlines (refer to Figure 4-1 for screenline locations). Figures 4-12 through 4-14 depict the HOV and transit person trips and mode shares at the screenlines.

HOV (3+)

Without specific TDM strategies, HOV usage in Alternative 1 is very similar to the No Action conditions. TDM strategies and impacts are discussed in the following section.

Transit

Without specific TDM strategies, transit usage at the Bothell screenline would increase to approximately 2 percent of total PM peak period person trips in Alternative 1. This represents more than a 100 percent increase in total transit person trips (i.e. an additional peak period 1000 person trips), although the screenline mode share remains small. At the Bellevue screenline, peak period transit usage would increase by 250 percent (i.e. an increase of over 6,000 peak period transit trips) compared to No Action. This produces an increase in transit mode share at the Bellevue screenline from 3 percent (No Action) to 7 percent (Alternative 1) due to the high concentration of transit services and High Capacity Transit facilities in that area. At the Renton screenline, peak period transit usage would increase by 80 percent (1,400 persons) compared to No Action, although the transit mode share would only increase from 2 to 3 percent.

The TDM program effects on transit are described in the next section. Alternative 1 also includes the potential effects of regional congestion pricing strategies within the I-405 study area. These strategies could result in a further shift to transit.

Transportation Demand Management Program Effects

Alternative 1 includes a TDM program that is common to each build alternative. This program would provide important financial and service incentives to encourage trip reduction. In addition, Alternative 1 includes the effects of a regional 'congestion pricing' strategy. These TDM effects were estimated separately from the other travel forecasting processes.

As shown in **Table 4-16**, the corridor TDM program was estimated to affect about 5 percent of the daily person demand within the study area, and up to 10 to 15 percent of the peak period demand. These results are based upon a review of comparable TDM programs around the nation applied to characteristics found within the I-405 corridor.

Table 4-16: I-405 TDM Program Effectiveness

TDM Element	Estimated Reduction in Daily Travel Demand*	Estimated Reduction in AM Peak Period Travel Demand*	Estimated Reduction in PM Peak Period Travel Demand*
Vanpooling	0.9%	2.7%	1.6%
Public Information	0.25 - 0.75%	1.0 – 2.0%	0.7 – 1.5%
Employer-Based	0.5 – 1.0%	2.0 – 3.5%	1.5 – 2.5%
Land Use as TDM	1.0 – 2.5%	3.5 – 5.0%	2.0 – 3.5%
Misc. Programs	0.5 – 1.0%	1.25 – 2.5%	0.75 – 1.25%
Total Estimated Travel Demand (VMT) Reduction	**3 – 6%**	**10 - 15%**	**7 – 10%**
Pricing**	15%	Not estimated	Not estimated
Total Estimated Travel Demand (VMT) Reduction (Alt. 1 only)*	**18 - 21% (Note: may include some double-counting of benefits)**	Not estimated	Not estimated

* Results measured in terms of reduction in vehicle mile of travel (VMT)
** Effectiveness for Pricing is included in Alternative 1 only. Regional congestion pricing effects have been studied as part of the Puget Sound Regional Councils *Metropolitan Transportation Plan* (Update, 2000)
Source: WSDOT, Urban Mobility Office

Taken as a whole, the transit and TDM strategies contained in Alternative 1 could result in a reduction of peak period single-occupant trips in the 10 percent range. The transit forecasts indicated that the improved transit mobility results in higher numbers of transit trips being made without affecting the total amount of vehicle trips (ie. slightly more overall trips are occurring within the corridor to offset the shift to transit). Therefore, most of the potential SOV trip reduction comes from the supportive effects of the TDM strategies.

The primary effects of the TDM program would be to shift single occupant vehicle users into carpools, vanpools, and transit. Some peak period and daily trips may also be eliminated. A sketch-planning analysis was conducted to estimate these relative effects on the different modes during the PM peak period. The preliminary findings show that possible effects of the TDM Program on the PM Peak Period for each mode are as follows: (without pricing effects).

- Single Occupant Vehicles (SOV) -- reduced 5-10 percent
- HOV (carpools, van pools) – increase up to 10 percent
- Transit – increase 20-30 percent depending on incentives
- Trips Eliminated – reduced less than 2 percent

Pricing Effects

Research to date indicates that congestion pricing can have a significant effect on overall regional travel. For example, a scenario was tested that in essence doubled the variable cost of driving a vehicle (approximately $0.20-0.25 per mile), which would vary by time of day and congestion levels. Under this scenario, short-range vehicle miles of travel were estimated to potentially be reduced by up to 15 percent on a daily basis. This scenario effectiveness is shown in Table 4-16. Additional research is being conducted at the PSRC to refine this estimate and to compare these effects to other TDM strategies that are included in the I-405 Alternatives.

Shares of Study Area Work Trips

This measure indicates the mode of travel chosen by workers within the study area. Most work trips occur during the peak periods and comprise around a quarter of total daily trips. The effects of the TDM program are not included in these modeling results.

In Alternative 1, the mode split of daily work person trips is as follows:

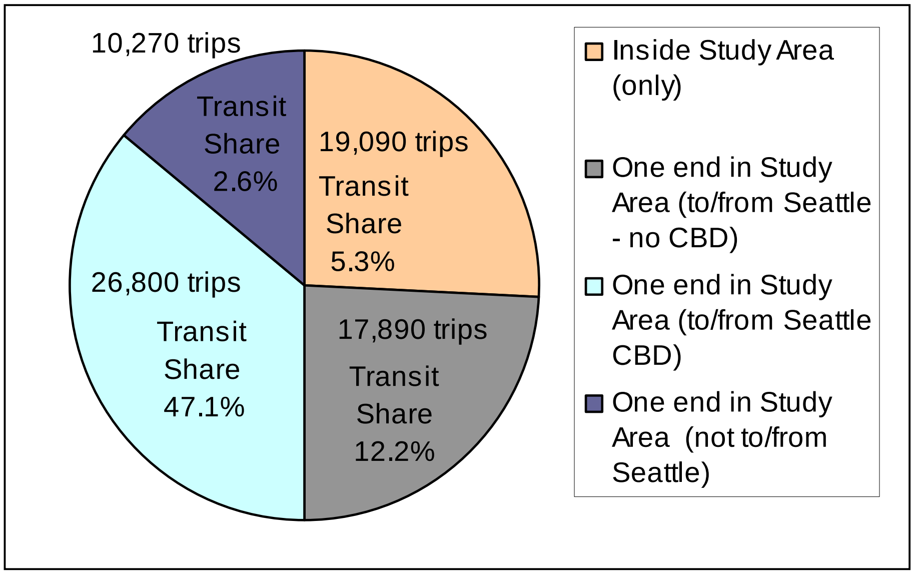
- Transit - 8 percent
- HOV 3+ - 19 percent
- Non-HOV (SOV, 2 person carpools, non-work HOV's) - 73 percent

SOV users represent approximately 50 percent of the total trips.

The transit mode share increases by 1 percent compared to No Action conditions. This translates to an additional 7,300 work person trips. Carpool trips are slightly lower than the No Action conditions, possibly reflecting a shift from carpooling to transit in this Alternative.

Transit work trip mode shares vary significantly by the destination of the trip. As shown in **Figure 4-16**, about three quarters of all work transit trips originating within the I-405 study area have a destination that is located outside of the study area. This is comparable to No Action conditions. In Alternative 1, there is a higher percent of work transit trips that stay internal to the study area, with a comparable drop (around 3 to 5 percent) in transit trips oriented to Seattle. This may be attributed to improved transit service connecting major origins and destinations within the study area. These mode shares are somewhat higher than the No Action Alternative.

Figure 4-16: Transit Work Trip Mode Shares by Destination - Alternative 1



Source: PSRC Model

Table 4-17 shows the transit work trips are oriented to different activity centers within the I-405 study area. These mode shares are somewhat higher than the No Action Alternative and reflect the focus of the HCT/fixed guideway system on serving the key study area centers.

Table 4-17: Daily Transit Trips Between I-405 Study Area and Activity Centers – Alternative 1

	Daily Work Trips 2020 No Action	Daily Work Trips 2020 Alternative 1
Bellevue CBD to/from Study Area	11,890	14,420
Transit Mode Share	27.2%	33.0%
Bothell CBD to/from Study Area	290	330
Transit Mode Share	1.9%	2.1%
Kirkland CBD to/from Study Area	290	380
Transit Mode Share	0.9%	1.1%
Overlake CBD to/from Study Area	610	800
Transit Mode Share	1.1%	1.5%
Redmond CBD to/from Study Area	70	90
Transit Mode Share	3.3%	4.3%
Renton CBD to/from Study Area	850	960
Transit Mode Share	11.5%	13.0%
Region-wide	349,970	357,850
Transit Mode Share	11.2%	11.4%

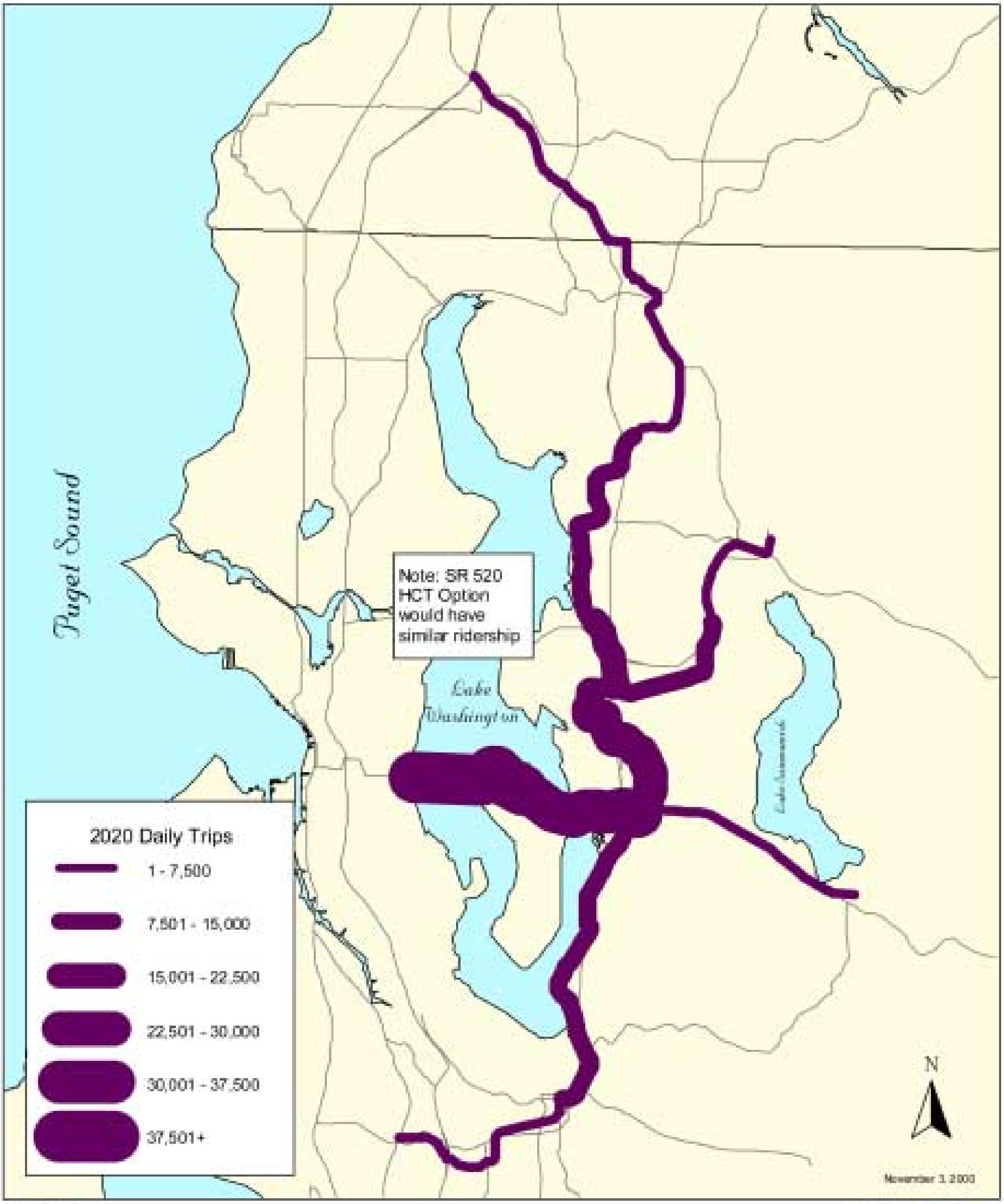
Source: PSRC Model (2000)

4.3.1.5.2 Transit Riders

PM Peak Period Transit Riders Along Key Segments

Daily transit ridership along the High Capacity Transit (HCT) segments of Alternative 1 is shown in **Figure 4-17**. The segments of highest ridership (e.g. at least 15,000 riders per day) fall within the central portion of the study area. This area extends roughly from South Kirkland, Downtown Bellevue, to Factoria. Ridership to the north and south along I-405 beyond these points is in the 7,500 to 15,000 range from Renton to Factoria, and from South Kirkland to Totem Lake. The Bellevue to Overlake segment also attracts ridership in that range. Outside of these segments, daily transit ridership on the HCT was estimated to fall below 7,500 persons.

Figure 4-17: High Capacity Transit Daily Ridership - Alternative 3

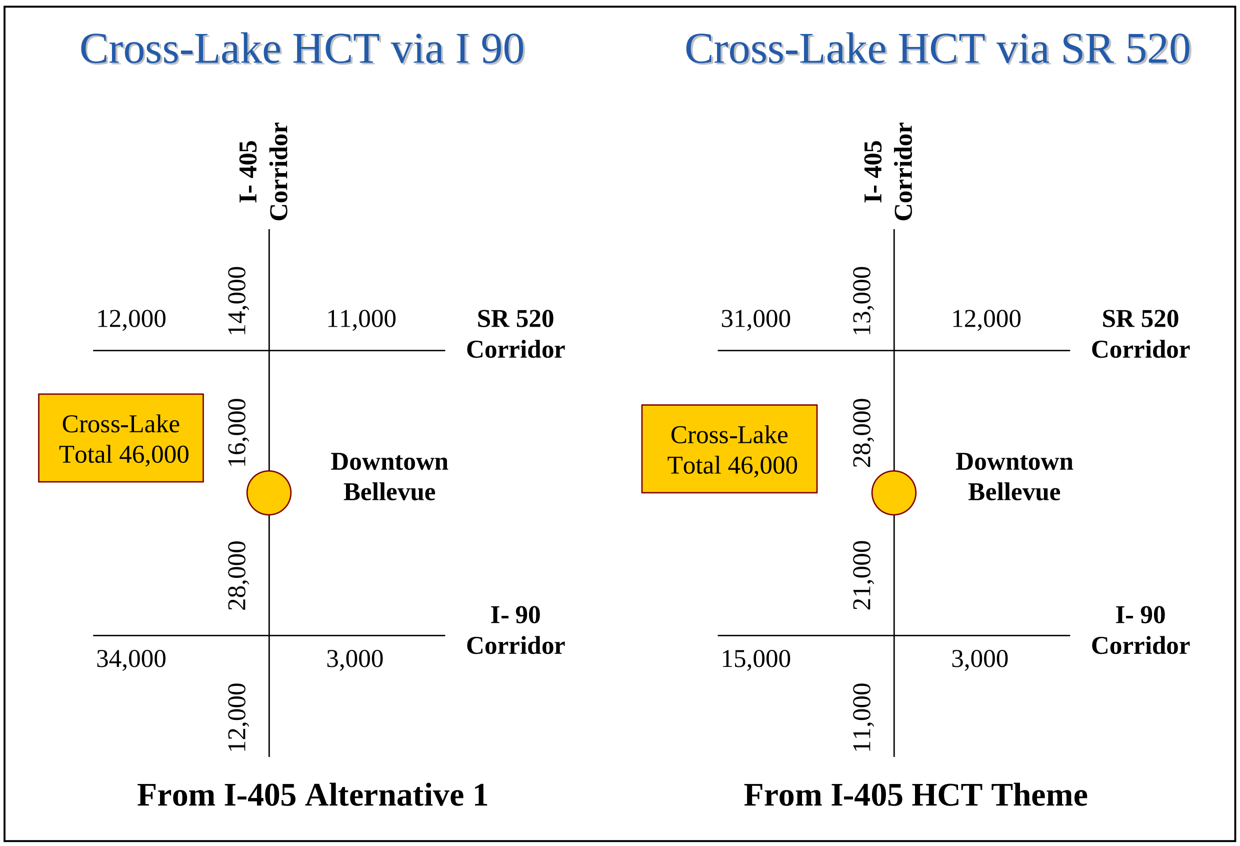


Source: PSRC Model, Parsons Brinckerhoff

Cross-Lake HCT Location

The HCT/fixed guideway network for Alternative 1 used the Sound Transit adopted Cross-lake Corridor I-90. The Trans-Lake Washington Study is currently examining alternative lake crossings, such as SR 520 and a midlake crossing. In order to determine the potential effects of an alternative HCT lake crossing, a sensitivity analysis was conducted. **Figure 4-18** illustrates that the choice of I-90 or SR 520 as an HCT crossing would not affect the transit ridership within the I-405 corridor, except within the downtown Bellevue segments. Total cross-lake ridership would be in the range of 46,000 riders per day regardless of the crossing location.

Figure 4-18: Comparison of 2020 Daily Transit Volumes Crossing Lake Washington



HCT Service Plan Sensitivity Test

As a sensitivity test, the transit forecast for Alternative 1 was re-run assuming a different HCT service plan. The overall HCT operating parameters (e.g. Vehicle speed, number of stations, alignment) were kept the same as Alternative 1. However, the sensitivity test service plan assumed that HCT vehicles would run directly from an origin station to the destination station for the passengers on that vehicle, bypassing intermediate station stops. This would result in faster transit trips along the HCT guideway. The service plan also assumed that this direct station-to-station service could occur between any stations on the Eastside HCT network, including the I-405, SR 520 and I-90 lines, allowing, for example, a direct no-transfer trip between Kirkland and Issaquah.

This service plan would result in increased transit usage throughout the study area. PM peak period transit person trips would increase across the Bothell screenline by 25 percent compared to the baseline Alternative 1; the share of transit trips, however, would remain small at about 2 percent of total person trips across the screenline. Across the Bellevue screenline, transit person trips would increase by about 14 percent ; transit's share of total trips would increase to 8 percent. Across the Renton screenline, transit person trips would increase by 6 percent; transit's share of total trips would be about 3 percent.

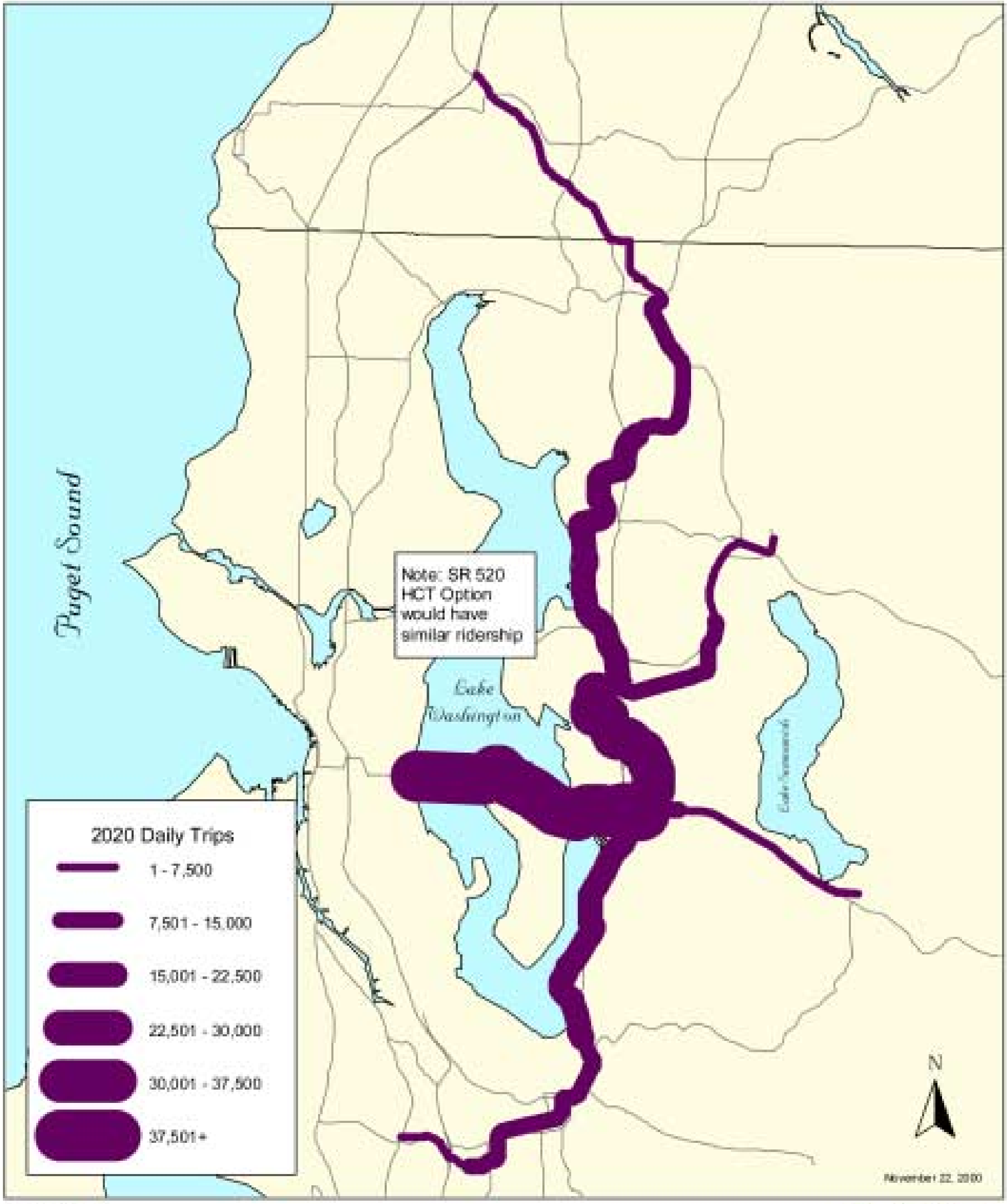
Daily transit ridership along the High Capacity Transit (HCT) segments of the Alternative 1 sensitivity test is shown in **Figure 4-19**. The general pattern of transit volumes is the same as for the baseline Alternative 1 shown in Figure 4-18, but with higher volumes throughout the system. The highest ridership falls within the central portion of the study area, between Factoria and Downtown Bellevue. This segment would carry over 30,000 daily riders for the sensitivity test, as compared to a daily ridership in the 22,500 to 30,000 range for the baseline Alternative 1. With the sensitivity test, segments carrying over 15,000 daily riders would extend north to Totem Lake and south to North Renton. Segments carrying volumes in the 7,500 to 15,000 range would continue north to Woodinville, south to Southcenter, east along I-90 to Eastgate, and east along SR 520 to Overlake. Outside of these segments, daily transit ridership on the HCT was estimated to fall below 7,500 persons.

Commuter Rail Sensitivity Test

A second sensitivity test assuming a commuter rail line estimated the 2020 daily ridership that could be expected on a commuter rail line from Tukwila to Kirkland in the absence of other HCT service in that corridor. This estimate did not involve original modeling but relied on information contained in previous studies of commuter rail in the corridor, specifically *Eastside Commuter Rail Feasibility Study Technical Memorandum*, prepared as part of Planning and Engineering Services for Phase II of the Regional Transit Project (by the Parsons Brinckerhoff/Kaiser Engineers Team, April 13, 1992,) and *Renton Commuter Rail Study Draft Final Report*, prepared as part of Planning and Engineering Services for Phase II of the Regional Transit Project (by the Parsons Brinckerhoff/Kaiser Engineers Team, April 1993.) The *Eastside Commuter Rail Feasibility Study* explored a commuter rail line from Tukwila to Kirkland, with a transfer to the South (Seattle-Tacoma) commuter rail line at Tukwila, while the *Renton Commuter Rail Study* explored the through-routing of trains from the South commuter rail onto an Eastside line extending to North Renton.

The two previous studies included ridership estimates for their proposed commuter rail services. At the same time, in the early 1990s, ridership estimates were prepared for an HCT line along the I-405 corridor. The previous HCT forecast volumes were lower than current forecasts which have been prepared for the I-405 Corridor Program in the area from Renton to Factoria, by about 35 percent. Therefore it's reasonable to assume that the earlier commuter rail forecasts are low by a similar percentage. Given this assumption, our estimate is that an Eastside commuter rail line from Tukwila to Kirkland would carry about 1,800 to 1,900 daily passengers in 2020. If the trains were directly routed form the I-405 corridor to Sound Transit's south commuter rail line to Tacoma, the ridership could grow 50 percent, to about 2,700 to 2,800 passengers a day.

Figure 4-19: High Capacity Transit Daily Ridership - Alternative 1 Sensitivity Test



Source: PSRC Model, Parsons Brinckerhoff

4.3.1.6 Criterion: Provide Effective Connections to Regional and Local Transportation Systems

This criterion is measured by looking at the following performance measures:

- Compatibility with regional systems
- Compatibility with local systems
- Accessibility to various mode choices.

4.3.1.6.1 Compatibility with Regional Systems

The urban centers of the Eastside and Seattle would be connected with a high capacity transit system under this alternative. The compatibility with the regional HCT system would be excellent. However, the I-405 HOV lanes would not be connected with direct freeway-to-freeway HOV ramps to the other freeway HOV lanes. The compatibility with the regional HOV system would be the same as the No Action Alternative.

This alternative assumes that there would be no major freeway improvements to enhance the general-purpose traffic connectivity. The compatibility with the regional freeway network is the same as No Action.

4.3.1.6.2 Compatibility with Local Systems

Overall, this alternative would make the compatibility problem slightly better than No Action. Improvements mean that this alternative does not improve mobility or the local system.

Regarding the general-purpose mode, this alternative would not address the existing and future incompatibility problems with the local roadway network. No direct actions would be taken to improve traffic congestion in most of the interchange areas along I-405. General-purpose includes truck freight movement and the lack of connecting arterials.

This alternative supports improvements on pedestrian and bicycle circulation. Those improvements would enhance the compatibility with local transportation systems.

■

4.3.2 Objective – Reduce Congestion

4.3.2.1 Criterion: Reduce Congestion on Study Area Freeways and Arterials Below Current Levels

This criterion is addressed by examining the following performance measures:

1) Hours of Traffic Congestion

- Hours of congestion in each segment of I-405 and arterial segments in a typical day
- Hours of congestion aggregated within the study area by freeway and arterial functional classification

2) Vehicles Miles and Hours of Travel

- Study area region-wide daily Vehicle Miles of Travel
- Study area and region-wide daily Vehicle Hours of Travel

4.3.2.1.1 Hours of Traffic Congestion

Hours of Congestion in Each Segment of I-405 and Within the Study Area

Table 4-18 shows the projected hours of congestion for Alternative 1, compared with No Action.

Although the high capacity transit system assumed to be in place by 2020 for this alternative would reduce traffic congestion slightly, it would not be enough to change hours of congestion. For all practical purposes, the hours of congestion under the Alternative 1 conditions are the same as No Action.

Table 4-18: Hours of Traffic Congestion by I-405 Segments - No Action and Alternative 1

I-405 Segment	No Action (hours)	Alt. 1 (hours)	Difference (Alt. 1-1999)
I-5 to SR 167	13	13	0
SR 167 to NE Park Dr.	14	14	0
NE Park Dr. to I-90	11	11	0
I-90 to SR 520	8	8	0
SR 520 to NE 85th Street	5	5	0
NE 85th Street to NE 124th Street	5	9	0
NE 124th Street to SR 522	8	8	0
SR 522 to I-5	6	6	0
Average of I-405	**7**	**7**	**0**
Average of Other Freeways	**5**	**5**	**0**
Average of Arterials	**5**	**5**	**0**
Average of All Facilities	**5**	**5**	**0**

Source: PSRC Model, Mirai Associates

4.3.2.1.2 Vehicle Miles of Travel

<u>**Study Area and Region-wide Daily Vehicle Miles, Hours of Travel, and Speeds**</u>

Vehicle Miles of Travel (VMT) is a measure of total vehicle trips multiplied by the length of the trip (in miles). VMT is summarized at the study area and regional level and portrays overall changes in travel activity that may occur in response to an alternative. Vehicle Hours of Travel (VHT) is a similar measure, but captures the quality of travel in terms of travel time. Average speed is calculated by dividing VMT by VHT. More detail is presented in Appendix H.

Table 4-19 summarizes the changes in study area and regional daily VMT and VHT for Alternative 1 compared to the No Action Alternative and the Baseline 1995. Before the effects of TDM strategies are considered, the change in VMT and VHT is very small from the No Action; significant differences from 1995. Average travel speeds were unchanged from No Action. The TDM program included in Alternative 1 was estimated to have a much larger incremental effect on VMT. The following components were estimated:

- TDM Incentives Program - 3-6 percent daily VMT reduction
- TDM Pricing Program - up to 15 percent daily VMT reduction

Changes in VHT and travel speeds due to the TDM program were not directly estimated, but could be considered to show similar trends to those shown for VMT reductions.

Table 4-19: VMT and VHT for Study Area and Region-wide - Alternative 1

Alternative	VMT (Daily)		VHT (Daily)	
	Study Area (trips within)	Region-wide	Study Area (trips within)	Region-wide
1995	16,346,000	69,412,000	586,000	2,295,000
2020 No Action	22,510,000	100,571,000	1,156,000	3,948,000
2020 HCT/TDM (Alt. 1)	22,563,000	100,497,000	1,155,000	3,941,000
Change vs. No Action (%)	0.2%	-0.1%	-0.1%	-0.2%
Change vs. 199535.0%	38.0%	44.7%	97.2%	71.7%
TDM Incentives Program	-3.0-6.0%	n/a	n/a	n/a
TDM Pricing Program	-15%	-15%	n/a	n/a

NA = effects cannot be directly estimated
Source: PSRC Model, Mirai Associates

4.3.2.1.3 Concurrency Impacts

Since Alternative 1 would not act to reduce the levels of traffic congestion on I-405, compared with the No Action Alternative, it would not be effective in addressing the concurrency problems at the local level. Unless local jurisdictions lower their acceptable levels of service standards, concurrency problems would continue to threaten growth in each local jurisdiction under this alternative.

■

4.3.3 Objective – Improve Safety

4.3.3.1 Criterion: Improve the Safety for All Modes Above Current Levels

This criterion is addressed by examining the following performance measures for safety issues:

- Potential for traffic accident reduction along high accident locations
- System Level Effects on Accidents
- Potential for improving safety for transit vehicles
- Potential for reducing conflicts between vehicles, peds and bikes

4.3.3.1.1 Potential for Traffic Accident Reduction Along High Accident Locations

This performance measure examines identified High Accident Locations (HAL's) documented within the study area by WSDOT and local agencies. **Table 4-20** summarizes the total number of safety improvements for I-405, I-5/I-90, and state routes within the study area. In general, there were a total of 60 HAL's identified. Alternative 1 would improve 19 of the identified HAL's, including about 40 percent of those identified along I-405.

Table 4-20: Safety Improvements Freeway and State Routes - Alternative 1

Facility	HAL Totals	No Action		Alternative 1	
		Total	%	Total	%
I-405	30	3	10%	12	40%
I-5, I-90	3	0	0%	1	33%
State Routes	27	6	22%	6	22%
Total	**60**	**9**	**15%**	**19**	**32%**

Source: Mirai Associates

Table 4-21 summarizes the total number of safety improvements for unincorporated King County and city streets within the study area. Each jurisdiction had a separate approach in identifying HAL's, and, therefore, unincorporated King County and city streets were judged separately than the freeways and state routes, which were accounted for and analyzed by WSDOT. In general, there were a total of 47 HAL's identified. Alternative 1 would improve four of the identified HAL's.

Table 4-21: Safety Improvements on Local Jurisdiction Streets - Alternative 1

Facility	HAL Totals	No Action		Alternative 1	
		Total	%	Total	%
Unincorporated King County and City Streets	47	3	6%	4	9%

Source: Mirai Associates

4.3.3.1.2 System-level Effects on Accidents

An analysis of system-level accident effects was conducted within the I-405 study area. The system-level analysis considered the following factors influencing traffic and safety:

- Type of Facility- Freeway, Arterial
- Facility Design Characteristics- Proportion of facility designed to standards
- Amount of Travel (measured by Vehicle Miles of Travel)
- Amount of Congestion
- Traffic Patterns

The following **Table 4-22** provides Vehicle Miles of Travel estimates for Alternative 1 compared to the 2020 No Action conditions:

Table 4-22: VMT by Facility Type - Alternative 1

Facility	No Action Daily VMT (Millions)	Alternative 1 Daily VMT (Millions)	Alternative 1 Percent Designed to Standard
I-405	3.95	3.94 (-0%)**	70%
Other Freeways	5.28	5.28 (-0%)**	60%
Arterials*	8.89	8.88 (-0%)**	Not Applicable
Total	**18.12**	**18.10**	

Source: PSRC Model; Mirai Associates
* Principal and minor arterials within the study area
** (percent change from No Action)

Design Standards: Basic improvements provided along the I-405 corridor were estimated to slightly upgrade the percentage of I-405 that would be designed 'to standard'. The design standards of other study area freeways (e.g. SR 520, I-90, SR 167) were assumed not to change.

Percent Congested: The analysis of study area congestion produced estimates of what proportion of the vehicle miles of travel on each facility would be congested on a daily basis. The following results in **Table 4-23** apply to current and No Action conditions.

Table 4-23: Congestion in Study Area - Alternative 1

Facility	No Action % VMT Congested	Alternative 1 % VMT Congested
I-405	94%	94%
Other Freeways	71%	71%
Arterials	63%	63%

Source: PSRC Model, Mirai Associates

Using these data, an estimate of study area accidents, annually, was made in **Table 4-24**.

Table 4-24: Annual Study Area Accidents – Alternative 1

Alternative	Total Accidents (rate)	Injury Accidents (rate)	Fatal Accidents (rate)
No Action (2020)	13,900 (2.10)	8,340 (1.26)	56 (0.84)
Alternative 1	13,840 (2.10)	7,480 (1.26)	55 (0.84)

Rate: per million VMT; Fata-per 100 million VMT
Source: Mirai Associates

The slight improvement in the number of accidents with Alternative 1 can be attributed to the basic improvements package of actions along I-405. The accident rates were unchanged from No Action conditions.

4.3.3.1.3 Potential for Improving Safety for Transit Vehicles

Transit vehicle and patron safety is affected by the degree of separation between modes and the provision of updated transit facilities. Alternative 1 will provide a physically-separated High Capacity Transit system that will provide a very safe transit environment. Transit patrons will benefit by new HCT transit stations and upgraded park-and-ride lots within the study area. These safety improvements will complement the completion of the core HOV system and committed HOV direct access projects and transit center projects as part of the No Action Alternative.

4.3.3.1.4 Potential for Reducing Conflicts Between Vehicles, Pedestrians, and Bicycles

Alternative 1 would improve nine of the 17 identified nonmotorized High Accident Locations (HAL's), as defined in the No Action Alternative. These results are shown in **Table 4-25**.

Table 4-25: Nonmotorized Safety Hazard Locations for Alternative 1

Shoulder Type	HAL Location Totals	Safety Improvement Totals			
		No Action		Alternative 1	
		Total	%	Total	%
No Sidewalk and No Paved Shoulder	6	0	0%	5	83%
No Sidewalk with Paved Shoulder	2	0	0%	2	100%
No Bike Lane and No Shoulder	9	0	0%	2	22%
Total	**17**	**0**	**0%**	**9**	**53%**

Source: Mirai Associates

Several other nonmotorized improvements (e.g. sidewalks, bicycle lanes) would be made as part of the planned and programmed arterial projects included in this alternative.

■

4.3.4 Construction Impacts

This alternative will have the least impact to existing traffic during construction compared to other "build" Alternatives because much of the HCT alignment is separated from existing roadways. HCT alignments that follow existing roadways would be located above, beside, or below the existing lanes. Stations and transit support facilities would be spread throughout the I-405 study area and their construction impacts to traffic would be of short duration. In Alternative 1, the basic freeway improvements could be completed by 2010, while the extensive high capacity transit system construction could extend until 2018.

4.4 ALTERNATIVE 2

Alternative 2 emphasizes transit through implementation of a HCT system and major expansion of bus transit service, similar to Alternative 1. It also emphasizes improved mobility for other travel modes by providing HOV and general-purpose roadway improvements on I-405 and connecting arterials. One general-purpose lane each direction is added to I-405. Alternative 2 also includes a TDM package of strategies.

■

4.4.1 Objective - Improve Mobility

4.4.1.1 Criterion: Serve as Much of the 2020 Peak Period Travel Demand Within the Corridor as Possible

This criterion is addressed by examining the following performance measures:

1) Person Volumes

- PM peak period person volumes by mode across 3 screenlines
- Daily person volumes by mode across 3 screenlines compared to unconstrained assignments

2) Vehicle Volumes

- PM peak period traffic volumes by types of vehicles (SOVs, HOVs, buses and trucks) at 3 screenlines
- Daily traffic volumes by types of vehicles (SOVs, HOVs, buses and trucks) at 3 screenlines
- Daily traffic volumes along segments of I-405
- Daily traffic volume shifts between facilities along selected screenlines

Daily demand values are described to place the peak period results into context with the entire day within the corridor.

4.4.1.1.1 Person Volumes

PM Peak Period Person Volumes by Mode Across 3 Screenlines

PM peak period (3 hours) travel demand was summarized as the number of persons passing through the study area at three screenline locations, as described in the No Action Alternative (Figure 4-1). Alternative 2 demand was compared against two benchmarks: No Action conditions, and a 2020 ‘unconstrained’ forecast.

In Alternative 2, the corridor handles 15 to 20 percent more peak period demand than the No Action. Most of the increase in demand occurs in the non-carpool and transit modes of use, as described more completely under the criterion “Reduce Share of SOV Travel”. There is a net increase in transit person trips caused by the expanded transit service and HCT, combined with an increase in non carpool volumes along I-405.

Alternative 2 results in some reductions in person demand on parallel arterials. While the Bothell arterial volumes stay constant, there is a 7-10 percent decrease on north-south arterials at the Bellevue and Renton screenlines (Figures 4-5 through 4-7).

Alternative 2 would result in peak period demand approaching the unconstrained demand. Unconstrained peak period demand would be exceeded at the Bothell and Bellevue screenlines. Daily person trips increase at a similar rate to peak period demand. For daily conditions, about 95 percent of the unconstrained demand would be satisfied, except for Renton with an unmet demand of around 20 percent. The corridor TDM effects would be similar to those described in Alternative 1. Congestion Pricing is not included in Alternative 2.

4.4.1.1.2 Vehicle Volumes

Daily and PM Peak Period Traffic Volumes by Types of Vehicles (SOVs, HOVs, and Trucks)

PM peak period vehicle travel demand was summarized at three screenline locations, as described in the No Action Alternative. Alternative 2 volumes were compared against No Action conditions. Appendix H presents additional detail for each screenline.

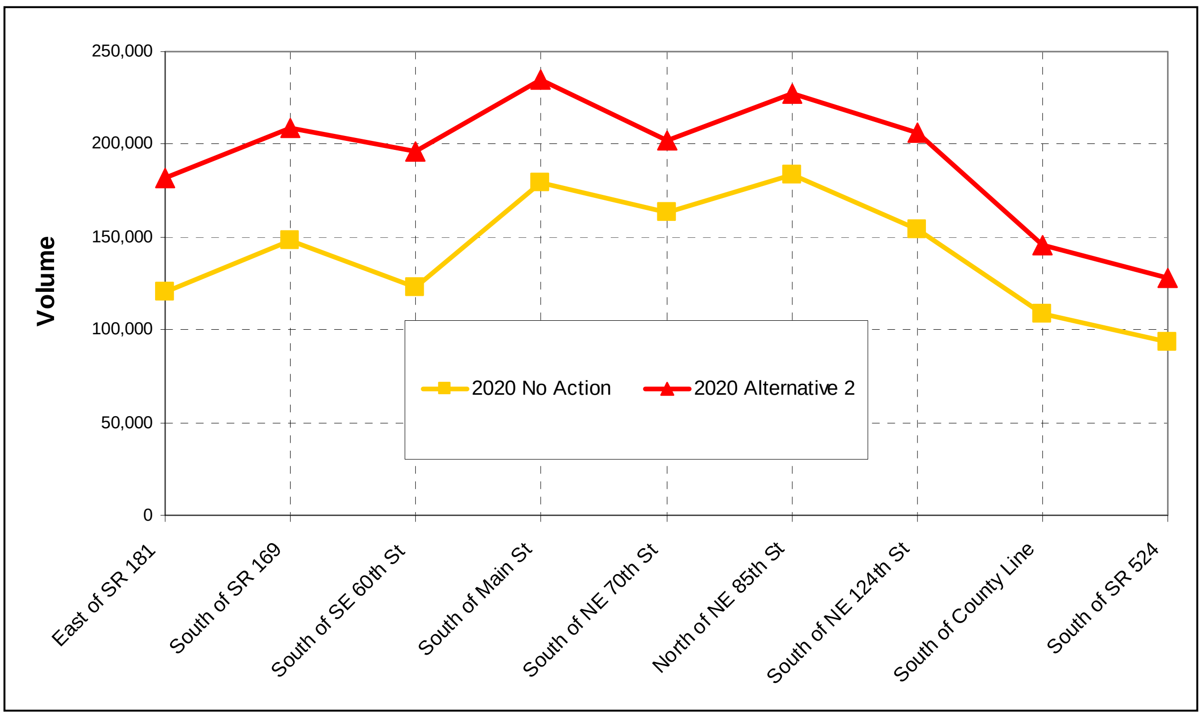
On average across the three screenlines, the peak vehicle demand in Alternative 2 increases by 10 to 15 percent from No Action conditions. Most of the increase in demand occurs in the non-carpool vehicles along I-405, with slightly higher percentage increases at the Renton screenline.

Alternative 2 results in some reductions in person demand on parallel arterials. While the Bothell arterial volumes stay constant, there is a 7 to 10 percent decrease on north-south arterials at the Bellevue and Renton screenlines. Daily vehicle trips increase at a similar rate to peak period demand. The corridor TDM effects would be similar to those described in Alternative 1. Congestion Pricing is not included in Alternative 2.

Daily Traffic Volumes Along Segments of I-405

Daily traffic volumes along I-405 in alternative 2 increase by 25—to 60 percent compared to the No Action volumes. The greatest traffic increases are south of I-90, with increases of 40 to 60 percent. As shown in **Figure 4-20**, this has the effect of somewhat balancing the vehicular demands along the corridor. The highest volumes continue to occur between I-90 and Totem Lake in Kirkland.

Figure 4-20: Daily Traffic Volumes along Segments of I-405- Alternative 2



Source: PSRC Model

Daily Traffic Volume Shifts Between Facilities Along Selected Screenlines

Alternative 2 produces small shifts in travel patterns within the I-405 corridor. As shown in **Table 4-26**, around one-third of the I-405 growth can be attributed to a demand shift from the I-5/SR99 corridor. This shift represents about a 1 to 2 percent reduction in north/south travel within Seattle. Over 50 percent of the I-405 growth is attributable to changing study area travel patterns and generally longer trips being made the remainder of the traffic shifts were from north-south arterials in the study area and from East King County. Other effects of induced travel associated with Alternative 2 are expected to be minimal.

Table 4-26: Sources of Traffic Volume Shifts on I-405 – Alternative 2

Source	Alternative 2	%
I-405	***45,000***	
Seattle I-5/SR 99	14,000.00	31%
Study Area North-South Arterials	5,000.00	11%
East King County Arterials	3,000.00	7%
Study Area Travel Patterns	23,000.00	51%

Source: PSRC Model, Mirai Associates

4.4.1.2 Criterion: Improve Predictability of Travel Times for All Modes

This criterion is measured by analyzing the predictability of the travel time in the corridor for general traffic, HOV, transit, and freight. Nonmotorized modes were not analyzed.

4.4.1.2.1 Effects on Travel Time Reliability by Mode

The general traffic travel time predictability in Alternative 2 would be better than the No Action Alternative. When the general-purpose lanes (one in each direction) are added those sections would be constructed to current design standards, enhancing safety and reducing incidents that slow down traffic. Since the duration of traffic congestion periods under this alternative would be shorter than under the No Action conditions, the traveler's ability to predict travel times would be improved. Freight and transit trip reliability would also be greatly improved.

The HCT/fixed guideway system would operate on an exclusive right-of-way with excellent reliability would not affect travelers on other parts of the transportation system. HOV 3+ travel time predictability would improve due to addition HOV direct access ramps.

4.4.1.3 Criterion: Provide Flexibility to Accommodate Post-2020 Travel Demands

This criterion is measured by looking at the future flexibility of the Alternatives using the following:

- Available Capacity at 2020
- Potential for Adaptability

4.4.1.3.1 Available Capacity at 2020

As described in Alternative 1, the HCT system would have substantial capacity to serve additional persons after 2020 by adding more vehicles to meet future demand. Table 4-27 shows that, in 2020, the peak demand on the fixed-guideway facility would use about 25 percent of the supplied capacity. Adding vehicles to the fixed-guideway facility investment would provide substantial additional capacity. Overall, high capacity transit has the potential for high levels of sustainability in terms of its capacity to respond to increased demand. Such capacity would need to be matched with future transit demand in the corridor.

Conversely, Alternative 2 would have minimal available roadway capacity remaining after 2020. Although the alternative could accommodate 2020 person demands that are up to 15 percent higher than No Action Alternative, this alternative would not accommodate the total demand within the corridor.

Table 4-27: High Capacity Transit Demand and Capacity in 2020 - Alternative 2

High Capacity Transit	Peak Hour/Direction	
	Bothell/Renton*	Bellevue*
Capacity Supplied	1,875	9,375
Demand	470-485	2,705
Maximum HCT Capacity	15,000	15,000

*Measured at 3 screenline locations within the I-405 corridor
Source: PSRC Model

I-405 congestion levels would improve to approximately current conditions in 2020 with the added capacity provide in Alternative 2. By 2030, daily traffic volumes within the study area would use up this limited available capacity for further person volume growth within the corridor. Volumes on already congested arterials would continue to increase in the forecasts.

4.4.1.3.2 Potential for Adaptability

Alternative 2, similar to Alternative 1, contains a fixed-guideway transit system that offers several opportunities for expansion and modification as demand and technology changes.

The I-405 and arterial elements would provide limited opportunities for further expansion unless additional capacity was incorporated into the facility design. The alternative includes several applications of Intelligent Transportation Systems (ITS) that will continue to maximize the efficiency of the current system.

4.4.1.4 Criterion: Reduce Travel Times for All Modes Door-to-Door Compared With Current Conditions

This criterion is addressed by the following performance measures.

- General traffic travel times
- HOV travel times
- Transit travel times

The door-to-door travel times for seven typical trips under Alternative 2 are compared with the No Action conditions. **Table 4-28** shows the travel times with the facility improvements in Alternative 2 for the general-purpose traffic and HOV (carpool (+3) and vanpool) modes. **Table 4-29** shows the transit travel times under Alternative 2 with two types of access to transit service -- walk-and-ride and park-and-ride.

4.4.1.4.1 General-purpose Traffic

The travel times for general-purpose traffic under Alternative 2 would be reduced. Travel time reductions for the seven trips range from one to seven minutes, in a 6 to 9 percent improvement over the No Action travel times.

4.4.1.4.2 HOVs (3+)

The travel times for HOVs (3+) under the Alternative 2 conditions would not change substantially from No Action. There may be one to two minutes of travel time reductions for certain trips.

4.4.1.4.3 Transit

Alternative 2 would improve transit travel times considerably compared to the No Action Alternative. The transit travel time reductions for the seven trips are almost the same as Alternative 1. Most of the travel time improvements are due to reductions in in-vehicle transit times. Walk access times also decrease due to more transit routes and more frequent service. As shown in Table 4-29, transit travel time range from 3 to 30 minutes for walk-and-ride access and 5 to 24 minutes for park-and-ride access. The largest travel time changes would occur for the trip from Tukwila/SeaTac to Redmond/Overlake with a 30-minute travel time reduction for walk-and-ride access. From Renton to Mill Creek, transit travel times would be shortened by up to 27 minutes. The Bellevue CBD to Edmonds/Lynnwood shows a relatively small amount of travel time reduction, only six to seven minutes.

Table 4-28: General and HOV Traffic PM Peak Travel Time Comparisons Between 2020 No Action and Alternative 2

Trips	General Traffic* Travel Time (Minutes)			HOV (3+) Travel Time (Minutes)		
	No Action	Alt. 2	Difference	No Action	Alt. 2	Difference
Bellevue CBD to Federal Way/Kent	79	72	-7	42	41	-2
Renton to Mill Creek	84	78	-6	51	50	-1
Bellevue CBD to Edmonds/Lynnwood	55	50	-5	36	36	0
Tukwila/Sea-Tac to Redmond/Overlake	61	57	-4	42	42	0
Issaquah/Cougar Mount. to Bothell/Kenmore	62	58	-4	45	45	0
Issaquah/Cougar Mount. to Federal Way/Kent	74	70	-5	51	50	-1

*Single occupant vehicles; 2-person carpools, trucks

Source: PSRC Model

Table 4-29: Transit PM Peak Travel Time Comparisons Between 2020 No Action and Alternative 2

Trips	Transit Travel Time with Walk-and-Ride Access (Minutes)			Transit Travel Time with Park-and-Ride Access (Minutes)		
	No Action	Alt. 2	Difference	No Action	Alt. 2	Difference
Bellevue CBD to Federal Way/Kent	95	77	-18	85	68	-17
Renton to Mill Creek	126	99	-27	112	89	-23
Bellevue CBD to Edmonds/Lynnwood	84	77	-7	73	67	-6
Tukwila/Sea-Tac to Redmond/Overlake	116	85	-30	102	78	-24
Issaquah/Cougar Mount. to Bothell/Kenmore	114	100	-14	104	92	-12
Issaquah/Cougar Mount. to Federal Way/Kent	130	108	-22	119	101	-18

Source: PSRC Model

4.4.1.5 Criterion: Reduce the Share of Peak Period and Daily Trips by Single Occupant Vehicles

This criterion is measured by analyzing the following performance measures:

- Modal Shares
- Transit Riders

4.4.1.5.1 Modal Shares

Percentage of Peak Period Persons Choosing Modes of Travel at 3 Screenlines

This performance measure summarizes the percentage of PM peak period persons utilizing alternative modes (HOV 3+ and transit) at each of three screenlines (refer to Figure 4.1 for screenline locations). Figures 4-12 through 4-14 depict the HOV and transit person trips and mode shares at the screenlines. These results do not reflect the specific effects of the Transportation Demand Management (TDM) Strategies, whose effects were estimated separately, as described below.

HOV (3+)

HOV usage in Alternative 2 is very similar to the No Action conditions and the same as Alternative 1. However, the share of person trips is lower, as shown in Figures 4.12 through 4.14. This is caused by the 10 to 15 percent increase in total person trips crossing the screenlines caused by the addition of general-purpose lanes to I-405. Most of the total person trip increase is in non-HOV modes.

Alternative 2 contains a TDM program, common to all Build Alternatives, that would provide significant financial and service incentives to encourage ridesharing. It is estimated that the combination of additional vanpools and carpooling incentives could result in up to a 10 percent increase in HOV 3+ mode share compared to the results shown above. This change is comparable to Alternative 1.

Transit

Transit usage in Alternative 2 is very similar to the No Action condition and the same as Alternative 1. However, the share of person trips is lower. This is caused by an increase in total person trips crossing the screenlines.

The TDM program, common to all the Build Alternatives would provide significant financial and service incentives to support increased transit use. It is estimated that these incentives could result in a 20 to 30 percent additional increase in peak period transit usage and mode share compared to the results shown above. This change is comparable to Alternative 1.

Single Occupant Vehicle Trip Reduction

Taken as a whole, the transit and TDM strategies contained in Alternative 2 could reduce peak period SOV trips by 10 percent. Transit forecasts indicate that the improved transit mobility results in higher numbers of transit trips being made without affecting the total amount of vehicle trips (i.e. slightly more overall trips are occurring within the corridor to offset the shift to transit). Therefore, most of the potential SOV trip reduction comes from the supportive effects of the TDM strategies.

Shares of Study Area Work Trips

Most work trips occur during the peak periods and comprise around a quarter of total daily trips. Forecasts show that the mode splits of daily work person trips in Alternative 2 are virtually the same as those reported for Alternative 1.

4.4.1.5.2 Transit Riders

PM Peak Period Transit Riders Along Key Segments

Daily transit ridership along the HCT fixed guideway segments of Alternative 2 are similar to those shown for Alternative 1 (Figure 4-17). The segments of highest ridership (at least 15,000 riders per day) fall within the central portion of the study area. This area extends roughly from South Kirkland, to Downtown Bellevue and Factoria. Ridership to the north and south along I-405 beyond these points is in the 7,500 to 15,000 range from Renton to Factoria, and from South Kirkland to Totem Lake. The Bellevue to Overlake segment also attracts ridership in that range. Outside of these segments, daily transit ridership on the HCT system was estimated to fall below 7,500 persons.

The results of the HCT sensitivity tests (i.e., enhanced transit service with skip stops; commuter rail) reported under Alternative 1 would also apply to Alternative 2.

4.4.1.6 Criterion: Provide Effective Connections to Regional and Local Transportation Systems

This criterion is measured by looking at the following performance measures:

- Compatibility with regional systems
- Compatibility with local systems

4.4.1.6.1 Compatibility with Regional Systems

As in the case with Alternative 1, this alternative would provide excellent connections among the designated urban centers with a high capacity transit system.

The compatibility with the regional HOV system would be much improved under this alternative. This alternative assumes that freeway-to-freeway HOV direct access connections will be built at the following I-405 interchanges: I-5 in the Tukwila area, SR 167 in Renton, I-90, SR 520, SR 522 and I-5 at Lynnwood. HOV’s would then have exclusive lanes to travel between the I-405 HOV system and other freeway HOV systems.

In addition to adding one general-purpose lane on I-405 in each direction, this alternative assumes that capacity of the freeways connecting with I-405, such as I-90, SR 520, SR 522 and I-5 would be expanded, with adequate interchange ramp capacity. Therefore, the compatibility with the regional general-purpose transportation network, including truck freight movement, would be much better than No Action Alternative.

4.4.1.6.2 Compatibility with Local Systems

Overall, this alternative would have high levels of compatibility with local transportation plans. Actions would be taken to improve arterials in the vicinity of the I-405 interchanges, and, the configuration and capacity of I-405 interchanges would be improved. Those improvements are designed to match the added general-purpose capacity on I-405 with arterial capacity. Together, these improvements would enhance general-purpose traffic, including truck movement. Many of the existing and anticipated incompatibility problems identified in the No Action Alternative would be addressed in the proposed improvements in this alternative.

Since most of the arterial improvements in this alternative have been adopted in the local transportation plans, actions to implement those improvements will make this alternative more compatible with local transportation plans.

■

4.4.2 Objective: Reduce Congestion

4.4.2.1 Criterion: Reduce Congestion on Study Area Freeways and Arterials Below Current Levels

This criterion is addressed by examining the following performance measures:

1) Hours of Traffic Congestion

➢ Hours of congestion in each segment of I-405 and arterial segments in a typical day

➢ Hours of congestion aggregated within the study area by freeway and arterial functional classification

2) Vehicles Miles and Hours of Travel

➢ Study area and region-wide daily vehicle miles of travel

➢ Study area and region-wide daily vehicle hours of travel

4.4.2.1.1 Hours of Traffic Congestion

Hours of Congestion in Each Segment of I-405 and Within the Study Area

The capacity improvements proposed in Alternative 2 would reduce hours of traffic congestion on most segments of I-405, compared with the No Action Alternative. The overall duration of congestion on I-405 would be reduced by six hours under Alternative 2, one hour less than No

Action. Alternative 2 would reduce hours of congestion substantially for the sections between I-90 and SR 520, between NE 85th Street and NE 124th Street, and between SR 522 and I-5. The sections of I-405 between I-90 and I-5 in Lynnwood would operate with less than 8 hours of congestion under Alternative 2. These operating conditions are better than the existing hours of congestion.

The south sections of I-405 between I-5in Tukwila and I-90 would continue to be congested under Alternative 2. For these sections, the duration of traffic congestion would last more than 12 hours a day. These operating conditions are slightly better than the existing conditions. One segment of I-405, NE Park Drive to I-90 would increase the duration of congestion by one hour. It is possible that added capacity in this segment may attract additional travel demands that would stretch the duration of congestion. Alternative 2 would also reduce the hours of congestion on arterials by one hour.

When all facilities are averaged, Alternative 2 would provide a small reduction in system-wide congestion reduction. **Table 4-30** summarizes the changes.

Table 4-30: Hours of Traffic Congestion by I-405 Segments for No Action and Alternative 2

I-405 Segment	No Action (hours)	Alt. 2 (hours)	Difference (Alt. 2-No Action)
I-5 to SR 167	13	12	-1
SR 167 to NE Park Dr.	14	13	-1
NE Park Dr. to I-90	11	12	+1
I-90 to SR 520	8	5	-3
SR 520 to NE 85th Street	5	5	0
NE 85th Street to NE 124th Street	5	8	1
NE 124th Street to SR 522	8	6	-2
SR 522 to I-5	6	3	-3
Average of I-405	**7**	**6**	**-1**
Average of Other Freeways	**5**	**4**	**-1**
Average of Arterials	**5**	**4**	**-1**
Average of All Facilities	**5**	**5**	**0**

Source: PSRC Model, Mirai Associates

4.4.2.1.2 Vehicles Miles and Hours of Travel

Study Area and Region-wide Daily Vehicle Miles, Hours of Travel, and Speeds

Vehicle Miles of Travel (VMT) is a measure of total vehicle trips multiplied by the length of the trip (in miles). VMT is summarized at the study area and regional level and portrays overall changes in travel activity that may occur in response to an alternative. Vehicle Hours of Travel

(VHT) is a similar measure, but captures the quality of travel in terms of travel time. Average speed is calculated by dividing VMT by VHT.

Table 4-31 summarizes the changes in study area and regional daily VMT and VHT for Alternative 2 compared to the No Action Alternative. Before the effects of TDM strategies are considered, the study area VMT would increase by up to 8 percent (+1% regionally), while changes in VHT are very small. The TDM program included in Alternative 2 was estimated to result in a 3 to 6 percent daily VMT reduction, which would offset the VMT increases created primarily by the added capacity provided on I-405. Changes in VHT due to the TDM program although not directly estimated, could be expected to show a similar reduction.

Table 4-31: VMT and VHT Study Area and Region-wide for Alternative 2

	VMT (Daily)		VHT (Daily)	
Theme	**Study Area (trips within)**	**Region-wide**	**Study Area (trips within)**	**Region-wide**
1995	16,346,000	69,412,000	586,000	2,295,000
2020 No Action	22,510,000	100,571,000	1,156,000	3,948,000
2020 Transit (Alt. 2)	24,215,000	101,560,000	1,164,000	3,922,000
Change vs. No Action (%)	7.6%	1.0%	0.7%	-0.7%
Change vs. 1995	48.1%	46.3%	98.6%	70.9%
TDM Incentives Program	-3.0-6.0%	NA	NA	NA

Source: PSRC Model, Mirai Associates

Average speeds are portrayed in **Table 4-32**. Alternative 2 results in an increase in average speed on I-405 during all time periods, while overall study area speeds improve slightly. Regional average speeds are virtually unchanged.

Table 4-32: Average Travel Speeds - Alternative 2

	Average Speed -MPH (AM Peak Period/PM Peak Period/Daily)		
Alternatives	**I-405**	**Study Area (Trips Within)**	**Region-wide**
2020 No Action	34/25/31	26/13/19	29/20/25
Alternative 2	38/28/35	27/13/21	29/20/26

Speeds in Miles per Hour; Does not include TDM effects
Source: PSRC Model

4.4.2.1.3 Concurrency

Alternative 2 adds capacity to I-405 and provides some reduction in study area traffic congestion, compared with the No Action Alternative. In addition, this alternative assumes that capacity of some arterials in the study area would be expanded. Therefore, this alternative would slightly reduce the magnitude of the concurrency problems that the local jurisdictions would face in the future. However, the concurrency improvement will be fairly limited since considerable unmet travel demand remains and few arterial improvements are included with this Alternative.

■

4.4.3 Objective: Improve Safety

4.4.3.1 Criterion: Improve the Safety for All Modes Above Current Levels

This criterion is addressed by examining the following performance measures for safety issues:

- Potential for traffic accident reduction along high accident locations
- System Level Effects on Accidents
- Potential for improving safety for transit vehicles
- Potential for reducing conflicts between vehicles, pedestrians, and bicycles

4.4.3.1.1 Potential for Traffic Accident Reduction Along High Accident Locations

This performance measure examines identified High Accident Locations (HAL's) documented within the study area by WSDOT and local agencies.

Table 4-33 summarizes the total number of safety improvements by alternative for I-405, I-5/ I-90, and state routes within the study area. In general, there were a total of 60 HAL's identified. Alternative 2 would improve 36 of the identified HAL's, including about 80 percent of those identified along I-405.

Table 4-33: Safety Improvements for Freeways and State Routes - Alternative 2

Facility	HAL Totals	No Action		Alternative 2	
		Total	%	Total	%
I-405	30	3	10%	24	80%
I-5, I-90	3	0	0%	1	33%
State Routes	27	6	22%	11	41%
Total	**60**	**9**	**15%**	**36**	**60%**

Source: PSRC Model, Mirai Associates

Table 4-34 summarizes the total number of safety improvements for Alternative 2 for unincorporated King County and city streets within the study area. Each jurisdiction had a separate approach in identifying HAL's, and, therefore, unincorporated King County and city streets were judged separately than the freeways and state routes, which were accounted for and analyzed by WSDOT. In general, there were a total of 47 HAL's identified. Alternative 2 would improve 9 of the identified HAL's.

Table 4-34: Safety Improvements on Local Jurisdiction Streets - Alternative 2

Facility	HAL Totals	No Action		Alternative 2	
		Total	%	Total	%
Unincorporated King County and City Streets	47	3	6%	9	19%

Source: Mirai Associates

4.4.3.1.2 System Level Effects on Accidents

An analysis of system-level accident effects was conducted within the I-405 study area. The system-level analysis considered the following factors influencing traffic and safety:

- Type of Facility- Freeway, Arterial
- Facility Design Characteristics- Proportion of facility designed to standards
- Amount of Travel (measured by Vehicle Miles of Travel)
- Amount of Congestion
- Traffic Patterns

The following **Table 4-35** provides vehicle miles of travel estimates for Alternative 2 compared to 2020 No Action conditions. Alternative 2 would result in an increase of study area VMT by approximately 9 percent.

Table 4-35: Summary of VMT by Facility Type in the Study Area - Alternative 2

Facility	No Action VMT (Millions)	Alternative 2 VMT (Millions)	Alternative 2 Percent Designed to Standard
I-405	3.95	5.44 (+ 38%)**	90%
Other Freeways	5.28	5.75 (+ 9%)**	60%
Arterials*	8.89	8.50 (- 4%)**	Not Applicable
Total	18.12	19.69 (+ 9%)**	

* Principal and minor arterials within the study area
** (percent change from No Action)
Source: PSRC Model, Mirai Associates

Design Standards: One additional general-purpose lane plus basic improvements would be provided along the I-405 corridor. These improvements would significantly upgrade the percentage of I-405 that would be designed 'to standard'. The design standards of other study area freeways (e.g. SR 520, I-90, SR 167) were assumed not to change.

Percent Congested: The analysis of study area congestion produced estimates of what proportion of the vehicle miles of travel on each facility would be congested on a daily basis. The following results in **Table 4-36** apply to Alternative 2 and No Action conditions.

Table 4-36: Facility Congestion in the Study Area – Alternative 2

Facility	No Action % VMT Congested	Alternative 2 % VMT Congested
I-405	94%	90%
Other Freeways	71%	63%
Arterials	63%	59%

Source: PSRC Model, Mirai Associates

Travel Patterns: The addition of one GP lane on I-405 has a limited effect on regional travel patterns. Up to 10 percent of the added traffic on I-405 would shift form the I-5/SR 99 corridor. These trips would come from facilities with similar accident rates and were removed from the total accidents associated with the I-405 Alternatives. Up to 5 percent of the trips would be shifted from arterial routes in East King County. Resulting in a net accident reduction due to the better accident rates on freeways compared to arterials.

Using these data, an estimate of annual study area accidents was made in **Table 4-37**.

Table 4-37: Estimate of Annual Study Area Accidents – Alternative 2

Alternative	Total Accidents (rate)	Injury Accidents (rate)	Fatal Accidents (rate)
No Action (2020)	13,900 (2.10)	8,340 (1.26)	56 (0.84)
Alternative 2	13,840 (1.93)	8,120 (1.13)	55 (0.77)

Rate: per million VMT; Fatal-per 100 million VMT
Source: Mirai Associates

The system-wide effect of improvements under Alternative 2 is a slight decrease in the rate and number of accidents despite the increase VMT that occurs with this alternative. The improvement in accidents and rates can be attributed to the shift of traffic from arterial routes to I-405 and the geometric improvements provided by the addition of one GP lane, and the basic improvements package of actions along I-405. A greater percentage of total traffic using freeways would result in a lower overall accident rate.

4.4.3.1.3 Potential for Improving Safety for Transit Vehicles

Transit vehicle and passenger safety is affected by the degree of separation between modes and the provision of updated transit facilities. Alternative 2 would provide a physically-separated HCT system that would provide a very safe transit environment. Transit passengers would benefit from new HCT transit stations and upgraded park-and-ride lots. These safety improvements would complement the completion of the core HOV system, committed HOV direct access projects, and transit center projects of the No Action Alternative.

4.4.3.1.4 Potential for Reducing Conflicts Between Vehicles, Pedestrians, and Bicycles

Alternative 2 would improve 9 of the 17 identified nonmotorized High Accident Locations (HAL's), as defined in the No Action Alternative. These results are shown in **Table 4-38**.

Table 4-38: Nonmotorized Safety Hazard Locations for Alternative 2

Shoulder Type	HAL Location Totals	Safety Improvement Totals			
		No Action		Alternative 2	
		Total	%	Total	%
No Sidewalk and No Paved Shoulder	6	0	0%	5	83%
No Sidewalk with Paved Shoulder	2	0	0%	2	100%
No Bike Lane and No Shoulder	9	0	0%	2	22%
Total	**17**	**0**	**0%**	**9**	**53%**

Source: Mirai Associates

Several other nonmotorized improvements (e.g. sidewalks, bicycle lanes) would be made as part of the planned and programmed arterial projects included in this alternative.

■

4.4.4 Construction Impacts

The HCT and transit impacts for Alternative 2 are similar to Alternative 1. This Alternative includes adding one lane in each direction on I-405 and requires modifications to most bridges and interchanges. Construction will require narrowing of lanes and shoulders, detours, and diversion of traffic to adjacent facilities. Although efforts will be made to maintain the existing number of lanes during construction, most traffic control measures will result in a decrease in capacity and increase in system-wide roadway congestion.

In Alternative 2, the freeway widening construction could extend over a 6- to 8-year period ending after 2010. The HCT system construction would likely follow the roadway construction to be complete by 2018. Arterial improvements would occur throughout the 2005 to 2015 period.

There would be anticipated construction impacts on traffic resulting from the reduction of lane capacity along I-405. The analyses suggest that spillover traffic to parallel arterial routes would occur during the construction period. Parallel arterial facilities such as Coal Creek Parkway, Bellevue Way, 148th Ave, SR 202, and Lake Washington Boulevard would likely experience some traffic increases. There would also be the potential for short-term increases in local street cut-through traffic to avoid construction-related traffic impacts. Implementation of an expanded TDM program and transit service would be essential to provide mobility choices to travelers during construction.

Appendix F identifies anticipated construction impacts on traffic and transit/HOV mode shares resulting from the reduction of lane capacity along I-405. These results suggest that spillover traffic to parallel arterial routes would occur, along with an increase in daily work trips by transit and HOV. Implementation of an expanded TDM program and transit service would be essential to provide mobility choices to travelers during construction.

4.5 ALTERNATIVE 3

This alternative emphasizes mobility improvements through implementation of a BRT/HOV system, substantial expansion of bus transit service, and substantial HOV and general-purpose roadway improvements on I-405 and connecting arterials. Two additional lanes in each direction replace the auxiliary and climbing lanes contained in the No Action Alternative. Alternative 3 includes a bus rapid transit system using the existing HOV lanes on I-405, I-90, and SR 522. Selected arterial missing links would be completed together with planned arterial capacity improvements of local jurisdictions.

■

4.5.1 Objective - Improve Mobility

4.5.1.1 Criterion: Serve as Much of the 2020 Peak Period Travel Demand Within the Corridor as Possible

This criterion is addressed by examining the following performance measures:

1) Person Volumes

- PM peak period person volumes by mode across 3 screenlines
- Daily person volumes by mode across 3 screenlines compared to unconstrained assignments

2) Vehicle Volumes

- PM peak period traffic volumes by types of vehicles (SOVs, HOVs, buses and trucks) at 3 screenlines
- Daily traffic volumes by types of vehicles (SOVs, HOVs, buses and trucks) at 3 screenlines
- Daily traffic volumes along segments of I-405
- Daily traffic volume shifts between facilities along selected screenlines

Daily demand values are described to place the peak period results into context with the entire day within the corridor.

4.5.1.1.1 Person Volumes

PM Peak Period Person Volumes by Mode Across 3 Screenlines

PM Peak period (3 hours) travel demand was summarized as the number of persons passing through the study area at three screenline locations, as described in the No Action Alternative (Figure 4.1). The Alternative 3 demand was compared against two benchmarks: No Action conditions and a 2020 'unconstrained' forecast.

On average, the peak person demand in Alternative 3 increases by 25 to 30 percent compared with No Action conditions (Figures 4-2 through 4-4). Demand on I-405 would increase by up to 75 percent on some segments. Most of the increase in demand occurs in non-carpool and transit use, as described under the criterion "Reduce share of SOV Travel". There is a net increase in transit person trips caused by the expanded transit service and the Bus Rapid Transit system (BRT), and a substantial increase in non carpool volumes along I-405.

Alternative 3 results in a 10-15 percent decrease in demand on north-south arterials at the Bellevue and Renton screenlines. At the Bothell screenline, the arterial demand stays about the same as in the No Action, although demand on I-405 increases by 75 percent. This effect is shown in Figures 4-5 through 4-7.

Daily Person Volumes by Mode Across 3 Screenlines

Daily person trips increase at a similar rate to peak period demand. Alternative 3 would result in peak period demands exceeding the unconstrained demand by around 8 percent. Unconstrained peak period demand would be exceeded at each of the screenlines. For daily conditions, the unconstrained demand would be exceeded at the Bellevue and Bothell screenlines, although there would remain up to a 10 percent unmet demand at the Renton screenline. The corridor TDM effects would be similar to those described in Alternative 2.

4.5.1.1.2 Vehicle Volumes

Daily and PM Peak Period Traffic Volumes by Types of Vehicles (SOVs, HOVs, and Trucks)

PM peak period (3 hours) vehicle travel demand was summarized at and volumes were compared against the No Action conditions.

On average across the three screenlines, the peak vehicle demand in Alternative 3 increases by 30 percent compared with No Action conditions. Demand on I-405 increases by around 66 percent at the Bothell and Bellevue screenlines and doubles in Renton. Increased commercial vehicle usage pushes the volumes higher at the south end of the corridor.

Alternative 3 results in a 10 percent decrease in demand on north-south arterials at Bellevue and Renton. At Bothell the arterial demand stays the same as No Action although demand increases by 70 percent on the I-405 screenline.

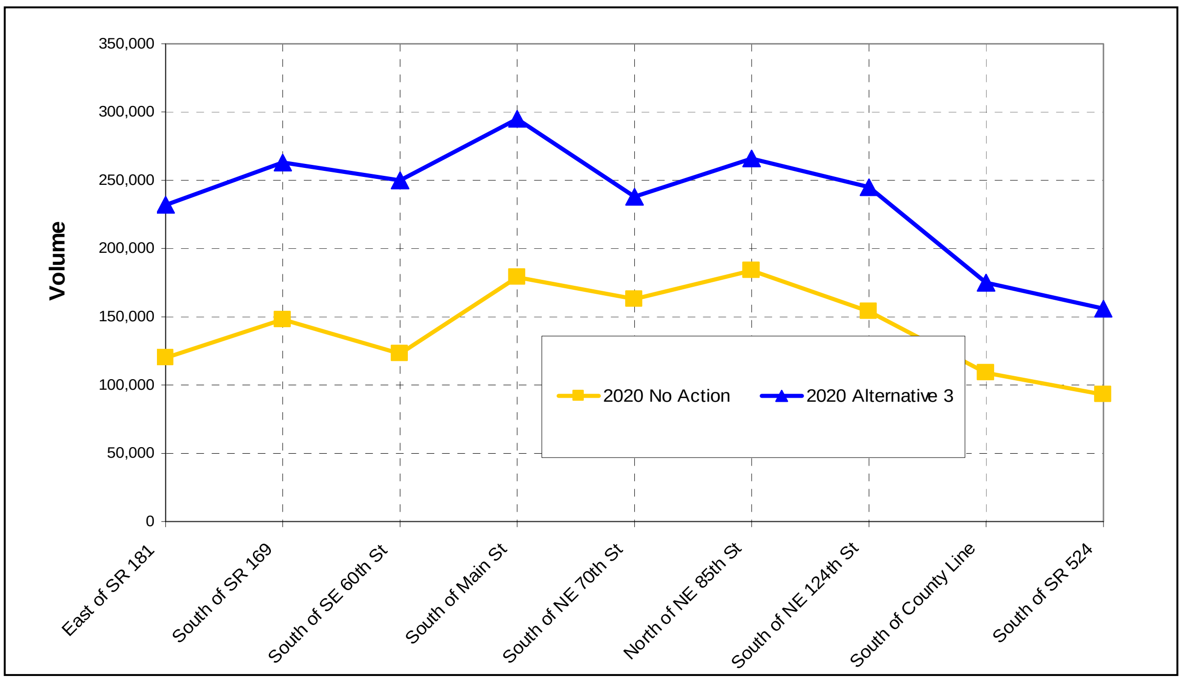
Daily vehicle trips increase at a similar rate to peak period demand.

The corridor TDM effects would be similar to those described in Alternative 2.

Daily Traffic Volumes Along Segments of I-405

Daily traffic volumes along I-405 in Alternative 3 increase by 45 to 100 percent compared to the No Action volumes. The greatest traffic increases are south of I-90, with increases of 80 to 100 percent. As shown in **Figure 4-21**, the traffic demands in the south segment are virtually identical to the I-405 segments through Kirkland. The highest volumes occur between I-90 and SR 520 in Bellevue.

Figure 4-21: Daily Traffic Volumes along Segments of I-405 - Alternative 3



Source: PSRC Model

Daily Traffic Volume Shifts Between Facilities Along Selected Screenlines

The major widening of I-405 in Alternative 3 results in substantial increases in peak period travel demand across the three major screenlines within the study area. Most of this growth shows up on I-405 itself. **Table 4-39** shows the basic sources for traffic growth I-405 in this alternative. Of the total increase in I-405 daily traffic (compared to No Action), up to 45 percent can be attributed to changing travel patterns and somewhat longer trips being made. Another major source for trip growth on I-405 is a shift in travel from the general I-5/SR 99 corridor through Seattle. This shift represents 30 to 35 percent of the I-405 demand increase and results in about a 3 percent reduction in north/south travel within Seattle. Lesser traffic shifts occur from the parallel north/south arterials in the I-405 corridor (10 to 15% of daily I-405 volume increase) and from East King County facilities (5 to 10%). A related effect of the widening of I-405 is the increase in travel demand on roadways connecting to I-405. Increases of around 10 percent were estimated on the east/west arterials and freeways (SR 520, I-90) that provide primary access to I-405.

The substantial increase in roadway capacity provided in Alternative 3 could result in shifts in land use patterns and study area trip making. A test was made to determine the land use effects of the improved accessibility provided by Alternative 3. The *I-405 Corridor Program Draft Land Use Expertise Report* (DEA, 2001) documents the results of this analysis, which showed that Alternative 3 causes some clustering of development patterns within the study area but does not affect the overall growth assumed by local and regional plans. In the short run after implementation (prior to 2020), the substantial improvement in mobility provided by Alternative 3 could result in an increase in the number of discretionary trips made within the corridor. By 2020 and beyond, these effects are expected to be minimal in comparison with the high growth in overall study area and regional trips produced.

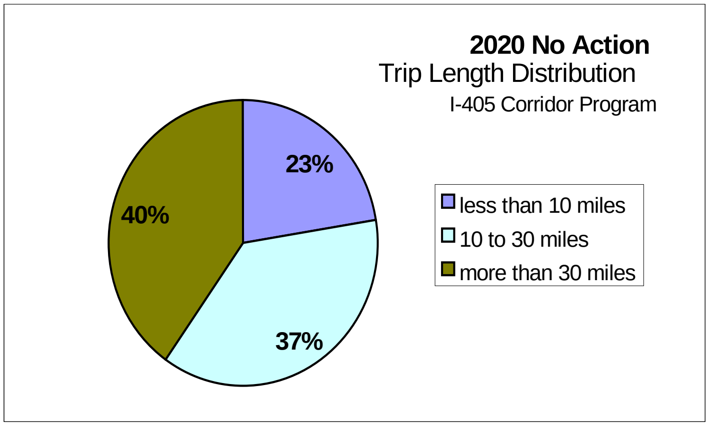
Changing trip patterns and mobility within the study area contribute to the increase in trip length for Alternative 3. **Figure 4-22** shows that over 90 percent of the added trips on I-405 (compared to No Action) would have trip lengths in excess of 10 miles, with almost 60 percent over 30 miles in length.

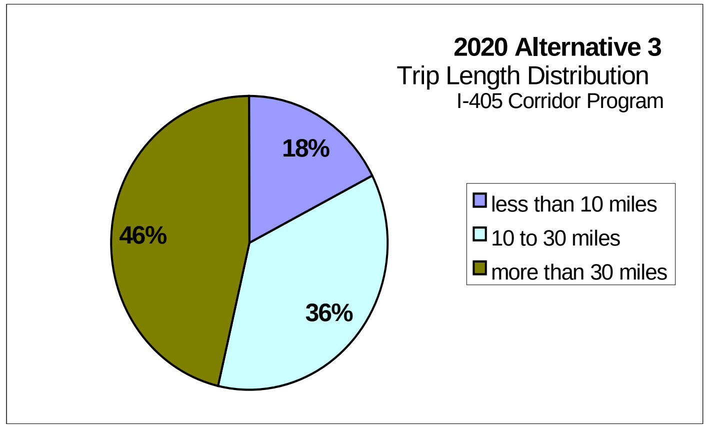
Table 4-39: Sources of Traffic Volume Shifts to I-405 – Alternative 3

Source	Alternative 3	%
I-405	*80,000*	
Seattle I-5/SR 99	27,000.00	34%
Study Area North-South Arterials	10,000.00	13%
East King County Arterials	7,000.00	9%
Study Area Travel Patterns	36,000.00	45%

Source: PSRC

Figure 4-22: Trip Length Effects on Traffic Patterns - Alternative 3





Source: PSRC Model, Parsons Brinckerhoff

4.5.1.2 Criterion: Improve Predictability of Travel Times for All Modes

This criterion is measured by analyzing the predictability of the travel time in the corridor for general traffic, HOV, transit, and freight. Nonmotorized modes were not analyzed.

4.5.1.2.1 Effects on Travel Time Reliability by Mode

This alternative would provide higher levels of general traffic travel time reliability than No Action. The expansions of I-405 mainline capacity under this alternative would improve general traffic. Each mainline section would be constructed to current standards, and many interchanges along I-405 would be upgraded to meet standards. As a result, this alternative would greatly improve the ability to manage incidents. The duration of traffic congestion would also lead to better travel time reliability for both general traffic and freight.

During the extensive construction period for Alternative 3, travel time reliability for general traffic will be difficult to manage. Innovative construction techniques will help maintain reliability during these periods.

HOV (3+) travel time predictability would improve due to additional HOV direct access ramps that allow HOV's to bypass congestion.

The Bus Rapid Transit (BRT) system in Alternative 3 would take advantage of the extensive HOV facilities to provide reliable bus travel times. This good reliability is dependent upon managing the demand in the HOV lanes by restricting their use to three-or-more person carpools. Other managed lane concepts have also been considered to ensure that transit reliability is given a high priority.

4.5.1.3 Criterion: Provide Flexibility to Accommodate Post-2020 Travel Demands

This criterion is measured by looking at the future flexibility of the Alternatives using the following:

- Available Capacity at 2020
- Potential for Adaptability

4.5.1.3.1 Available Capacity at 2020

Alternative 3 would have available corridor person capacity remaining after 2020. Alternative 3 could accommodate 2020 person demand that is up to 25 percent higher than No Action conditions, and equal to the theoretical unconstrained demand.

The Bus Rapid Transit (BRT) element of Alternative 3 would have capacity to serve additional persons after 2020. **Table 4-40** shows that, in 2020, the peak demand on the BRT would use up to 30 percent of the supplied capacity. The BRT system can easily respond to increased demand by adding buses. A BRT system should be able to meet additional post 2020 ridership demand in the corridor provided that additional bus equipment and operating revenues are available; park/ride and transit center capacity are sufficient; and speed and reliability performance criteria are met running in a predominantly HOV land ROW environment. Long-term demand may require transit center expansion and reserved bus lanes and curb space in urban centers.

Table 4-40: High Capacity Transit Demand and Capacity in 2020- Alternative 3

Bus Rapid Transit	Peak Hour/Direction		
	Bothell	Bellevue*	Renton*
Capacity Supplied	1,265	7,265	840
Demand	295	2,255	200
Maximum HCT Capacity	9,000	9,000	9,000

* Measured at 3 screenline locations within the I-405 Corridor
Source: PSRC Model

I-405 congestion levels would improve to better than current conditions in 2020 with the added capacity provide in Alternative 3. By 2030, daily traffic volumes within the study area would use up most of this available capacity for further person volume growth within the corridor.

4.5.1.3.2 Potential for Adaptability

Alternative 3 contains a BRT system that offers limited post 2020 opportunities for physical facility expansion within the I-405 ROW. However, lane designation and user group management modification, including the introduction of a HOT lane, offer long range BRT system enhancement opportunities. In addition, ITS innovations would help maximize the efficiency for present and future systems.

4.5.1.4 Criterion: Reduce Travel Times for All Modes Door-to-Door Compared With Current Conditions

This criterion is addressed by the following performance measures.

- General Traffic travel times
- HOV travel times
- Transit Travel Times

The door-to-door travel times for seven typical trips under Alternative 3 were compared to the No Action conditions. **Table 4-41** shows the travel times with the facility improvements in Alternative 3 for the general-purpose traffic and HOV (carpools (3+) and vanpools) modes. **Table 4-42** shows the transit travel times in Alternative 3 with two types of access to transit service --- walk-and-ride and park-and-ride.

4.5.1.4.1 General-purpose Traffic

Compared with the No Action travel times, Alternative 3 would substantially reduce travel times for general-purpose traffic, including truck freight. The travel time reduction would be 11 to 16 percent (7 to 12 minutes).

Although the travel time reductions are substantial for this alternative, the general traffic travel times under Alternative 3 would still remain 4 to 12 minutes longer than the 1995 travel times (see **Table 4-41**). However, for trips focused directly on I-405, travel times could be expected to improve to similar or better than current travel times.

4.5.1.4.2 HOVs

The travel times for HOVs (3+) under the Alternative 3 conditions would not change significantly from No Action. There may be one to two minutes of travel time reduction for certain trips.

4.5.1.4.3 Transit

Alternative 3 would improve transit travel times considerably compared to the No Action Alternative, but the savings would be less than Alternatives 1 and 2. As shown in **Table 4-42**, the transit travel time improvements for the seven trips from 4 to 27 minutes for walk-and-ride access and from 4 to 19 minutes for park-and-ride access. The largest travel time changes would occur for the trip from Tukwila / SeaTac to Redmond / Overlake with a 19 to 27 minute travel time reduction. From Renton to Mill Creek, the transit travel times would be shortened by 17 minutes. The trip from Bellevue to Lynnwood / Edmonds would show a relatively small amount of travel time reduction.

Most of the travel time improvements are due to reductions in in-vehicle transit times. Walk access times also decrease due to more transit routes and more frequent service.

Table 4-41: General and HOV Traffic PM Peak Travel Time Comparisons Between 2020 No Action and Alternative 3

	General Traffic* Travel Time (Minutes)			HOV Travel Time (Minutes)		
Trips	**No Action**	**Alt. 3**	**Difference**	**No Action**	**Alt. 3**	**Difference**
Bellevue CBD to Federal Way/Kent	79	67	-12	42	41	-2
Renton to Mill Creek	84	73	-12	51	50	-1
Bellevue CBD to Edmonds/Lynnwood	55	46	-9	36	36	-4
Tukwila/Sea-Tac to Redmond/Overlake	61	53	-8	42	42	-1
Issaquah/Cougar Mount. to Bothell/Kenmore	62	55	-7	45	45	-1
Issaquah/Cougar Mount. to Federal Way/Kent	74	68	-7	51	50	-1

*Single occupant vehicles; 2-person carpools, trucks

Source: PSRC Model

Table 4-42: Transit PM Peak Travel Time Comparisons Between 2020 No Action and Alternative 3

	Transit Travel Time with Walk-and-Ride Access (Minutes)			Transit Travel Time with Park-and-Ride Access (Minutes)		
Trips	**No Action**	**Alt. 3**	**Difference**	**No Action**	**Alt. 3**	**Difference**
Bellevue CBD to Federal Way/Kent	95	82	-12	85	73	-12
Renton to Mill Creek	126	109	-17	112	95	-17
Bellevue CBD to Edmonds/Lynnwood	84	80	-4	73	67	-6
Tukwila/Sea-Tac to Redmond/Overlake	116	88	-27	102	83	-19
Issaquah/Cougar Mount. to Bothell/Kenmore	114	99	-15	104	91	-13
Issaquah/Cougar Mount. to Federal Way/Kent	130	116	-14	119	107	-12

Source: PSRC Model

4.5.1.5 Criterion: Reduce the Share of Peak Period and Daily Trips by Single Occupant Vehicles

This criterion is measured by analyzing the following performance measures:

- Modal Shares
- Transit Riders
- TDM

4.5.1.5.1 Modal Shares

Percentage of Peak Period Persons Choosing Modes of Travel at 3 Screenlines

This performance measure summarizes the percentage of PM peak period persons utilizing alternative modes (HOV 3+ and transit) at each of three screenlines (refer to Figure 4.1 for screenline locations). Figures 4-12 through 4-14 depict the HOV and transit person trips and mode shares at the screenlines.

HOV (3+)

Without specific TDM strategies, HOV3+ usage in Alternative 3 is very similar to the No Action Alternative. The share of person trips is lower, as shown in Figures 4-13 through 4-15. This trend is especially apparent in Figure 4-15 at the Renton screenline. Total person trips crossing the screenline increase 25 to 30 percent with the addition of general-purpose lanes on I-405. Most of the total person trip increase is in non-HOV modes.

The TDM program effects in Alternative 3 would be similar to Alternative 2. It is estimated that the combination of additional vanpools and carpooling incentives could result in up to a 10 percent increase in HOV (3+) mode share compared to the results shown above.

Transit

Without specific TDM strategies, the transit share e at the Bothell screenline in Alternative 3 would remain at approximately 1 to 2 percent of total PM peak period person trips. While this represents a 50 percent increase in total transit person trips (i.e. an additional peak period 300 person trips), the screenline mode share remains small. At the Bellevue screenline, peak period transit usage would increase by 220 percent (i.e. an increase of about 5,000 peak period transit trips) compared to No Action. This produces an increase in transit mode share at the Bellevue screenline from 3 to 5 percent due to the high concentration of transit services and BRT facilities in that area. At the Renton screenline, peak period transit usage would increase 25 percent (+400 persons) compared to No Action, but transit mode share would remain at about 2 percent.

Alternative 3 contains TDM strategies to encourage and support transit use. It is estimated that these incentives could result in a 20 to 30 percent additional increase in peak period transit usage and mode share compared to the results shown.

Single Occupant Vehicle Trip Reduction

Taken as a whole, the transit and TDM strategies contained in Alternative 3 could result in a reduction of peak period single-occupant trips in the 10 percent range. These effects are comparable with the results of Alternative 2.

Shares of Study Area Work Trips

This measure indicates the mode of travel chosen by workers within the study area. Most work trips occur during the peak periods and comprise around a quarter of total daily trips. The mode split of daily work person trips in Alternative 3 is similar to Alternative 1. Overall work transit trips are 5 percent higher than in Alternative 1 and 20 percent higher than No Action. This change is likely due to slight differences in transit patterns between the HCT/fixed guideway (Alternative 1) and the BRT (Alternative 3) services.

4.5.1.5.2 Transit Riders

PM Peak Period Transit Riders Along Key Segments

Daily transit ridership along the Bus Rapid Transit (BRT) segments of Alternative 3 are similar to those shown for the HCT segments of Alternative 1 (**Figure 4-23**). Ridership in the 7,500 to 15,000 range extends somewhat further to the north (NE 85th St) and south (NE 44th St) along I-405 compared to Alternative 1. Conversely, ridership in the Bellevue to Overlake/Redmond segments is lower with this alternative. Outside of these segments, daily transit ridership on the BRT was estimated to fall below 7,500 persons.

4.5.1.6 Criterion: Provide Effective Connections to Regional and Local Transportation Systems

This criterion is measured by looking at the following performance measures:

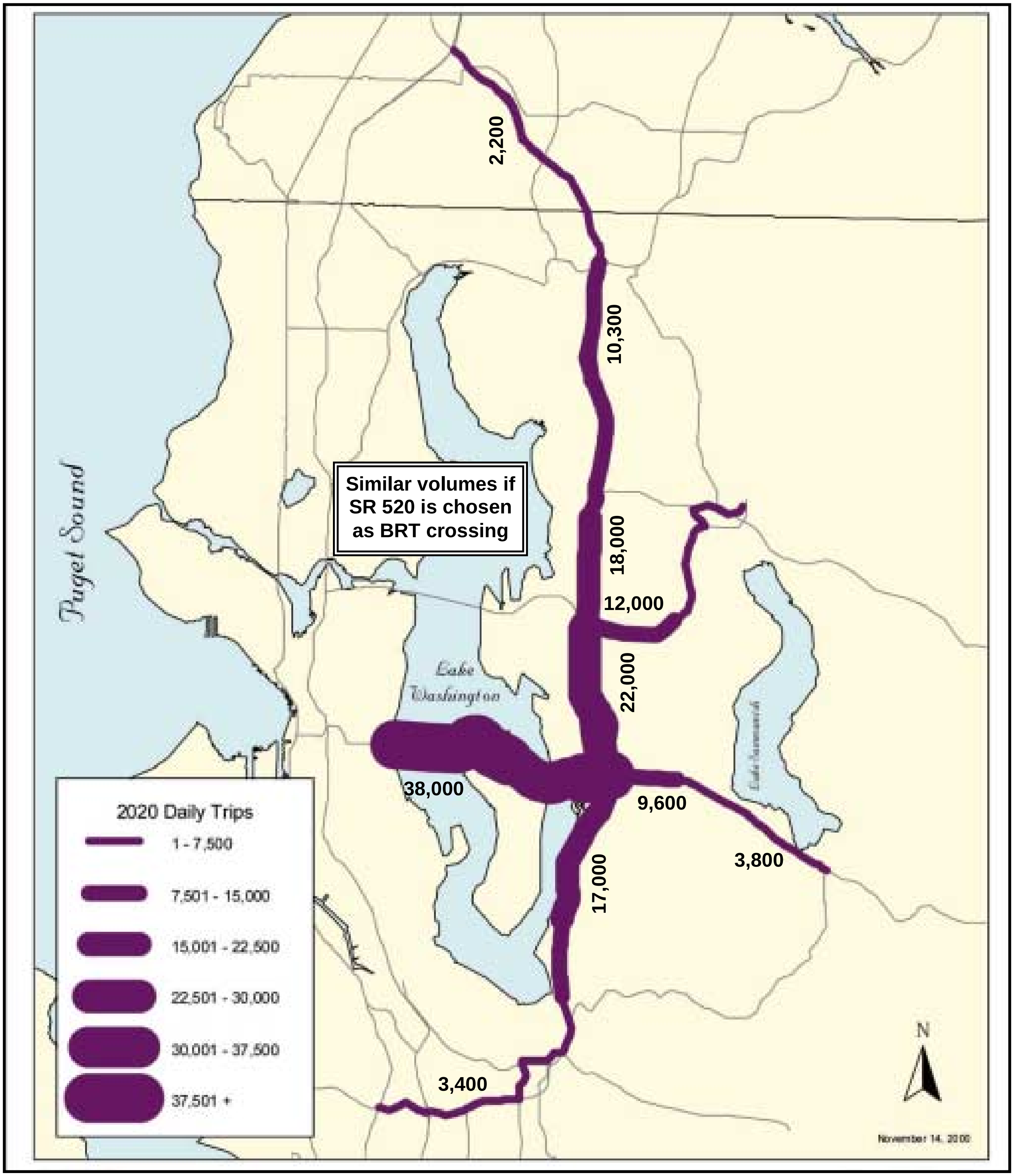
- Compatibility with regional systems
- Compatibility with local systems
- Accessibility to various mode choices.

4.5.1.6.1 Compatibility with Regional Systems

This alternative assumes that the urban centers would be served by a bus rapid transit system using the HOV lanes and direct HOV access interchanges. The freeway-to-freeway direct HOV ramp connections would also be provided. These HOV interchanges would also allow interface with the regional passenger rail network. Overall, the transit system compatibility with the regional system is much better in Alternative 3 than the No Action Alternative.

The general-purpose traffic capacity of I-405 would be expanded substantially under this alternative as well as the connecting freeway capacity. The ramp capacity of the interchanges will be also significantly expanded to match the mainline I-405 capacity expansions. As a result, the compatibility with the regional general-purpose transportation network would be better than under the No Action Alternative.

Figure 4-23: Daily Bus Rapid Transit Volumes - Alternative 3



4.5.1.6.2 Compatibility with Local Systems

Overall, this alternative would have high levels of compatibility with local transportation plans.

Under this alternative, actions would be taken to improve arterials in the vicinity of the major I-405 interchanges and the capacity of the I-405 interchanges. These improvements are designed to match the added general-purpose capacity on I-405 with arterial and ramp capacity. Many of the existing and anticipated incompatibility problems would be addressed with the proposed improvements in this alternative. General-purpose traffic, including truck freight movement, would improve substantially.

Since most of the arterial improvements in this alternative have been adopted in the local transportation plans, actions to implement those improvements would make this alternative compatible with local transportation plans.

■

4.5.2 Objective – Reduce Congestion

4.5.2.1 Criterion: Reduce Congestion on Study Area Freeways and Arterials Below Current Levels

This criterion is addressed by examining the following performance measures:

1) Hours of Traffic Congestion

- Hours of congestion in each segment of I-405 and arterial segments in a typical day
- Hours of congestion aggregated within the study area by freeway and arterial functional classification

2) Vehicles Miles and Hours of Travel

- Study area and region-wide daily vehicle miles of travel
- Study area and region-wide daily vehicle hours of travel

4.5.2.1.1 Hours of Traffic Congestion

Hours of Congestion in Each Segment of I-405 and Within the Study Area

Alternative 3 would reduce hours of traffic congestion substantially as shown in Table 4-43. Hours of congestion in the southern sections of I-405 would be shortened significantly. The section of I-405 between SR 167 and I-5 would be shortened by four hours of congestion each day, compared with No Action conditions.

Most of the segments in the north section from I-90 to I-5 in Lynnwood would operate with less than 5 hours of congestion, which would be much better conditions than the conditions today.

It appears that the I-405 capacity expansion from NE Park Drive to I-90 and the arterial improvements would not be enough to reduce the hours of congestion significantly in the mid section of I-405. Despite significant capacity expansions assumed in this alternative, hours of congestion would increase by two hours in the mid section of I-405.

When hours of traffic congestion for the entire I-405 segments are averaged, five hours of congestion are projected, which is two hours less than the No Action and better than current conditions. The average hours of congestion on arterials would also improve by one hour.

When all facilities are averaged, Alternative 3 would have about 4 less hours of congestion in the system, a one hour improvement from No Action conditions. The system-wide average congestion level in 2020 under Alternative 3 is similar to current conditions.

Table 4-43: Hours of Traffic Congestion by I-405 Segments - No Action and Alternative 3

I-405 Segment	No Action (hours)	Alt. 3 (hours)	Difference (Alt. 3-No Action)
I-5 to SR 167	13	6	-7
SR 167 to NE Park Dr.	14	10	-4
NE Park Dr. to I-90	11	13	+2
I-90 to SR 520	8	5	-3
SR 520 to NE 85th Street	5	4	-1
NE 85th Street to NE 124th Street	5	5	4
NE 124th Street to SR 522	8	5	-2
SR 522 to I-5	6	1	-5
Average of I-405	**7**	**5**	**-2**
Average of Other Freeways	**5**	**4**	**-1**
Average of Arterials	**5**	**4**	**-1**
Average of All Facilities	**5**	**4**	**-1**

Source: PSRC Model, Mirai Associates

4.5.2.1.2 Vehicles Miles and Hours of Travel

Study Area and Region-wide Daily Vehicle Miles, Hours of Travel, and Speeds

Table 4-44 summarizes the changes in the study area and the regional daily VMT and VHT for Alternative 3. Before the effects of TDM strategies are considered, the study area VMT would increase by up to 13 percent (+2 percent regionally). Regional VMT would increase by 1 percent, although regional VHT would decrease. The TDM program would result in reducing daily VMT by 3 to 6 percent. This reduction would tend to offset part of the VMT increases created primarily by the substantial added capacity provided on I-405 and connecting facilities. Changes in VHT due to the TDM program were not directly estimated, but could be considered to show similar trends to those shown for VMT reductions.

Table 4-44: Study Area and Region-wide Vehicle Miles and Hours of Travel – Alternative 3

Alternative	VMT (Daily)		VHT (Daily)	
	Study Area (trips within)	Region-wide	Study Area (trips within)	Region-wide
1995	16,346,000	69,412,000	586,000	2,295,000
2020 No Action	22,510,000	100,571,000	1,156,000	3,948,000
2020 Mixed Mode (Alt.3)	25,346,000	102,263,000	1,170,000	3,907,000
Change vs. No Action (%)	12.6%	1.7%	1.2%	-1.0%
Change vs 1995 (%)	55.0%	47.3%	99.7%	70.2%
TDM Incentives Program	-3.0-6.0%	NA	NA	NA

Source: PSRC Model, Mirai Associates

Average speeds are portrayed in **Table 4-45**. Since I-405 and study area VMT increases much more than VHT with this alternative, there is a substantial improvement in overall vehicle speeds within the corridor. Regional average speeds improve slightly during the PM peak period and for average daily conditions.

Table 4-45: Average Travel Speeds- Alternative 3

	Average Speed -MPH (AM Peak Period/PM Peak Period/Daily)		
Alternative	I-405	Study Area (Trips Within)	Region-wide
2020 No Action	34/25/31	26/13/19	29/20/25
Alternative 3	42/32/39	28/14/22	29/21/26

Speeds in Miles per Hour
Does not include TDM effects
Source: PSRC Model

4.5.2.1.3 Concurrency Impacts

The capacity expansions on I-405 assumed in Alternative 3 would shift some traffic back to I-405 from the arterials. Additional arterial capacity would also be provided. As a result, the levels of service on the freeway and arterial system are expected to improve, compared with the No Action Alternative. These actions would assist local jurisdictions to better manage their concurrency problems. Since Alternative 3 would take several years to implement, short-term concurrency issues will remain.

■

4.5.3 Objective: Improve Safety

4.5.3.1 Criterion: Improve the Safety for All Modes Above Current Levels

This criterion is addressed by examining the following performance measures for safety issues:

- Potential for traffic accident reduction along high accident locations
- System Level Effects
- Potential for improving safety for transit vehicles
- Potential for reducing conflicts between vehicles, pedestrians, and bicycles

4.5.3.1.1 Potential for Traffic Accident Reduction Along High Accident Locations

This performance measure examines identified High Accident Locations (HAL's) documented within the study area by WSDOT and local agencies.

Table 4-46 summarizes the total number of safety improvements by alternative for I-405, I-5/I-90, and state routes within the study area. In general, there were a total of 60 HAL's identified. Alternative 1 would improve 36 of the identified HAL's, including about 80 percent of those identified along I-405.

Table 4-46: Safety Improvements for Alternative 3

Facility	HAL Totals	No Action		Alternative 3	
		Total	%	Total	%
I-405	30	3	10%	24	80%
I-5, I-90	3	0	0%	1	33%
State Routes	27	6	22%	11	41%
Total	60	9	15%	36	60%

Source: Mirai Associates

Table 4-47 summarizes the total number of safety improvements for Alternative 3 for unincorporated King County and city streets within the study area. Each jurisdiction had a separate approach in identifying HAL's, and, therefore, unincorporated King County and city streets were judged separately than the freeways and state routes, which were accounted for and analyzed by WSDOT. In general, there were a total of 47 HAL's identified. Alternative 3 would improve 9 of the identified HAL's as shown in Table 4-40.

Table 4-47: Safety Improvements on Local Jurisdiction Streets for Alternative 3

Facility	HAL Totals	No Action		Alternative 3	
		Total	%	Total	%
Unincorporated King County and City Streets	47	3	6%	9	19%

Source: Mirai Associates

System Level Effects

An analysis of system-level accident effects was conducted within the I-405 study area. The system-level analysis considered the following factors influencing traffic and safety:

- Type of Facility- Freeway, Arterial
- Facility Design Characteristics- Proportion of facility designed to standards
- Amount of Travel (measured by Vehicle Miles of Travel)
- Amount of Congestion
- Traffic Patterns

Ta**ble 4-48** provides vehicle miles of travel estimates for Alternative 3 compared to 2020 No Action conditions. Alternative 3 would result in an increase of study area VMT by approximately 15%, with most of this increase occurring on I-405.

Table 4-48: Summary of VMT by Facility Type for Alternative 3

Facility	No Action VMT (Millions)	Alternative 3 VMT (Millions)	Alternative 3 % Designed to Standard
I-405	3.95	6.71 (+ 70%)**	90%
Other Freeways	5.28	5.80 (+ 10%)**	60%
Arterials*	8.89	8.31 (- 7%)**	Not Applicable
Total	18.12	20.82 (+ 15%)**	

* Principal and Minor Arterials within the study area
** (percent change from No Action)
Source: PSRC Model, Mirai Associates

Design Standards: Two additional general-purpose lane plus basic improvements would be provided along the I-405 corridor. These improvements would significantly upgrade the percentage of I-405 that would be designed 'to standard'. The design standards of other study area freeways (e.g. SR 520, I-90, SR 167) were assumed not to change.

Percent Congested: The analysis of study area congestion produced estimates of what proportion of the vehicle miles of travel on each facility would be congested on a daily basis. The comparison of Alternative 3with No Action conditions are shown in **Table 4-49**.

Table 4-49: Congestion in the Study Area – Alternative 3

Facility	No Action % VMT Congested	Alternative 3 % VMT Congested
I-405	94%	86%
Other Freeways	71%	67%
Arterials	63%	56%

Source: PSRC Model, Mirai Associates

Travel Patterns: The addition of two GP lanes on I-405 was estimated to have an effect on regional travel patterns. Up to 30 percent of the added traffic on I-405 could shift form the I-5/SR 99 corridor. These trips would divert from facilities with similar accident rates and were removed from the total accidents associated with the I-405 Alternatives. Up to 10 percent of the trips are estimated to shift from arterial routes in East King County. These trips would result in a net accident reduction due to the better accident rates on freeways compared to arterials.

Using these data, an estimate of annual study area accidents and rates was made in **Table 4-50**.

Table 4-50: Study Area Accidents for Alternative 3

Alternative	Total Accidents (rate)	Injury Accidents (rate)	Fatal Accidents (rate)
No Action (2020)	13,900 (2.10)	8,340 (1.26)	56 (0.84)
Alternative 3	13,640 (1.79)	7,920 (1.04)	54 (0.71)

Rate: per million VMT; Fatal – per 100 million VMT
Source: Mirai Associates

Accidents and accident rates with Alternative 3 could be expected to reduce slightly, despite the 15 percent increase in study area VMT that occurs with this alternative. While accidents would rise on I-405 due to significantly added volumes, there would be a reduction in arterial accidents. In summary, the improvement in accidents with Alternative 3 can be attributed to the shift of traffic from arterial routes to I-405 and the geometric improvements provided by the addition of two GP lanes plus the basic improvements package of actions along I-405. A greater percentage of total traffic now using the freeway system (See Table 4-41) will result in a lower overall accident rate.

4.5.3.1.2 Potential for Improving Safety for Transit Vehicles

Transit vehicle and patron safety is affected by the degree of separation between modes and the provision of updated transit facilities. Alternative 3 will provide a Bus Rapid Transit (BRT) system that will be largely physically-separated from other traffic. The BRT system is expected to provide a very safe transit environment. Transit patrons will benefit by new BRT transit stations and upgraded park-and-ride lots within the study area. These safety improvements will complement the completion of the core HOV system and committed HOV direct access projects and transit center projects as part of the No Action Alternative.

4.5.3.1.3 Potential for Reducing Conflicts Between Vehicles, Pedestrians, and Bicycles

Alternative 3 would improve 9 of the 17 identified nonmotorized High Accident Locations (HAL's), as defined in the No Action Alternative. These results are shown in **Table 4-51**.

Table 4-51: Nonmotorized Safety Hazard Locations - Alternative 3

Shoulder Type	HAL Location Totals	Safety Improvement Totals			
		No Action		Alt. 3	
		Total	%	Total	%
No Sidewalk and No Paved Shoulder	6	0	0%	5	83%
No Sidewalk with Paved Shoulder	2	0	0%	2	100%
No Bike Lane and No Shoulder	9	0	0%	2	22%
Total	17	0	0%	9	53%

Source: Mirai Associates

Several other nonmotorized improvements (e.g. sidewalks, bicycle lanes) would be made as part of the planned and programmed arterial projects included in this alternative.

■

4.5.4 Construction Impacts

The duration of freeway construction impacts for Alternative 3 on traffic could extend to 10 to 12 years because of the additional lane miles. During the construction period, travel time reliability for general traffic would be difficult to manage. Innovative construction techniques would help maintain reliability during these periods.

The process of adding two lanes in each direction on I-405 would increase the duration and extent of impacts to traffic throughout the study area. Existing lanes can be maintained at the expense of reduced capacity and increased congestion. These results suggest that spillover traffic to parallel arterial routes would occur during the construction period. Parallel arterial facilities such as Coal Creek Parkway, Bellevue Way, 148th Ave, SR 202, and Lake Washington Boulevard would likely experience some traffic increases. There would also be the potential for short-term increases in local street cut-through traffic to avoid construction-related traffic impacts.

Implementation of an expanded TDM program and transit service on the BRT system would be essential to provide mobility choices to travelers during construction. The bus rapid transit system can begin service in the short term on the existing HOV lanes and can provide opportunities to accommodate the corridor person demand that is affected during freeway construction. The north-south arterial improvements included in Alternative 3 could also occur earlier (e.g., 2006-2012) in the construction period to provide some traffic relief to persons affected by the freeway construction.

Appendix F identifies anticipated construction impacts on traffic and transit/HOV mode shares resulting from the reduction of lane capacity along I-405. These results suggest that spillover traffic to parallel arterial routes would occur, along with an increase in daily work trips by transit and HOV. Implementation of an expanded TDM program and transit service would be essential to provide mobility choices to travelers during construction.

4.6 ALTERNATIVE 4

This alternative emphasizes general-purpose capacity by providing one additional lane in each direction on I-405, improving major interchanges, and constructing a new four-lane I-405 express roadway consisting of two lanes in each direction with limited access points. In addition, there would be an expansion of major arterial routes and connections to I-405. Limited transit service expansion and the core TDM strategies would also be included.

■

4.6.1 Objective - Improve Mobility

4.6.1.1 Criterion: Serve as Much of the 2020 Peak Period Travel Demand Within the Corridor as Possible

This criterion is addressed by examining the following performance measures:

1) Person Volumes

- PM peak period person volumes by mode across 3 screenlines
- Daily person volumes by mode across 3 screenlines compared to unconstrained assignments

2) Vehicle Volumes

- PM peak period traffic volumes by types of vehicles (SOVs, HOVs, buses and trucks) at 3 screenlines
- Daily traffic volumes by types of vehicles (SOVs, HOVs, buses and trucks) at 3 screenlines
- Daily traffic volumes along segments of I-405
- Daily traffic volume shifts between facilities along selected screenlines

Daily demand values are described to place the peak period results into context with the entire day within the corridor.

4.6.1.1.1 Person Volumes

PM Peak Period Person Volumes by Mode Across 3 Screenlines

PM peak period (3 hours) travel demand is defined as the number of persons passing through the study area at three screenline locations. (Figure 4-1). The Alternative 4 demand was compared against two benchmarks: No Action conditions, and the 2020 "unconstrained" forecast.

The major widening of I-405 in Alternative 4, including the express roadway, would result in substantial increases in peak period travel demand across the screenlines. Most of this growth shows up on I-405 itself.

On average across the three screenlines, the peak person demand in Alternative 4 increases by 30 to 35 percent compared with No Action conditions (Figures 4-2 through 4-4). Demand on I-405 (including the express roadway) increases about 70 percent in downtown Bellevue and over 80 percent at the Renton and Bothell screenlines. Most of the increase in demand occurs in the non-carpool modes (SOV and HOV+2) using the additional lanes on the I-405 mainline and the express roadway.

Alternative 4 results in a 10 to 15 percent decrease in demand on north-south arterials at the Bellevue and Renton screenlines. At the Bothell screenline, the arterial demand stays about the same as No Action, while demand on I-405 increases by 85 percent. This effect is shown in Figures 4-5 through 4-7.

Daily Person Volumes by Mode Across 3 Screenlines

Daily person trips increase at a similar rate to peak period demand. Alternative 4 would result in peak period demands exceeding the unconstrained demand by over 10 percent. Unconstrained peak period demand would be exceeded at each of the screenlines. For daily conditions, the unconstrained demand would be exceeded at the Bellevue and Bothell screenlines, although there would remain up to a 5 percent unmet demand at the Renton screenline.

The corridor TDM effects would be similar to those described in Alternative 2.

4.6.1.1.2 Vehicle Volumes

Daily and PM Peak Period Traffic Volumes by Types of Vehicles (SOVs, HOVs, Buses and Trucks)

PM peak period (3 hours) vehicle travel demand was summarized at three screenline locations and compared against the No Action conditions.

On average across the three screenlines, the peak vehicle demand increases by 38 percent compared with No Action conditions. Demand on I-405 (including the express roadway) increases by around 80-90 percent in Bothell and downtown Bellevue and over 100 percent at the Renton and Bothell screenlines. Most of the increase in demand occurs in the non-carpool and commercial vehicle modes that use the new lanes on the I-405 mainline and the express roadway.

A 10 to 15 percent decrease in vehicle demand on north-south arterials occurs at the Bellevue and Renton screenlines. At the Bothell screenline, the arterial demand stays about the same as No Action, while demand on I-405 increases by 90 percent.

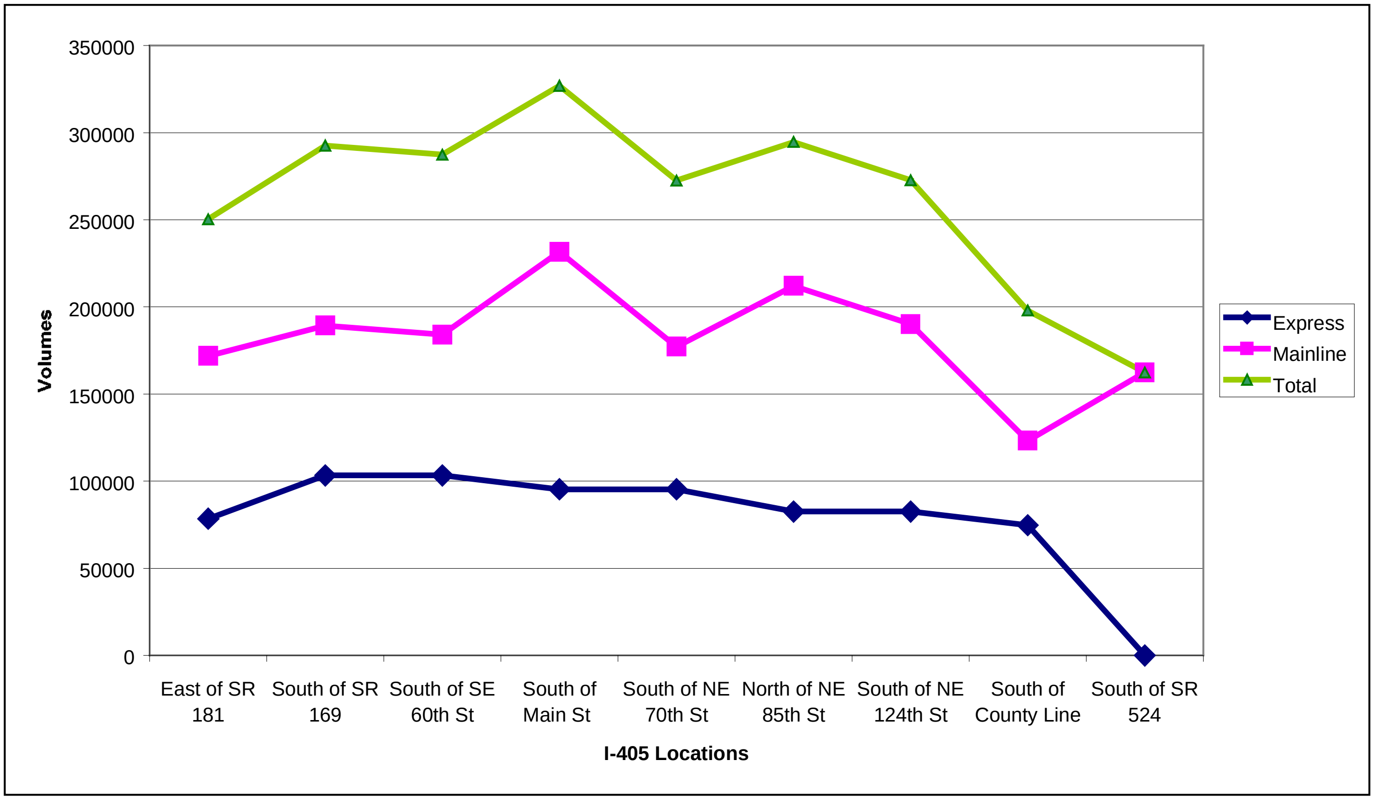
Daily vehicle trips increase at a similar rate to peak period demand.

The corridor TDM effects will be the same as in Alternative 2.

Daily Traffic Volumes Along Segments of I-405

Daily traffic volumes along I-405 in Alternative 4 increase by 60 to 130 percent compared to the No Action volumes. The greatest traffic increases are south of I-90, with increases in excess of 100 percent. As shown in **Figure 4-24** the traffic demands in the south segment exceed the I-405 segments through Kirkland. The express roadway demands are relatively consistent within the corridor, ranging from 75,000 to over 100,000 vehicles per day (assuming no management of the lanes using tolls). The express roadway would carry 60 to 80 percent of the total traffic growth within the corridor.

Figure 4-24: Daily Traffic Volumes along Segments of I-405 - Alternative 4



Source: PSRC Model

Daily Traffic Volume Shifts Between Facilities Along Selected Screenlines

The major widening of I-405 in Alternative 4, including the express roadway, results in significant increases in peak period travel demand across the three major screenlines within the study area. Most of this growth shows up on I-405 itself. The overall travel shifts were found to be similar to Alternative 3 as shown in **Table 4-52.** Around 80 percent of the traffic growth on I-405 (mainline and express) can be attributed to changing study area travel patterns and shifts from the Seattle I-5/SR99 corridor. The remainder of the traffic shifts were from north-south arterials in the study area and from East King County arterials.

However, Alternative 4 has unique features due to the express roadway. It appears that from 20 to 30 percent of the express roadway demand are trips passing through the study area from north to south. This is a much higher percentage of through trips than is evidenced in the No Action condition. At the south end, at least 30 percent of the express roadway trips would originate along the SR 167 corridor, while 40 to 50 percent would originate along I-5 south. Up to 70 to 75 percent of the trips using the express roadway would be diverted from the I-405 mainline, 25 to 30 percent would shift from the I-5 corridor, and around 5 percent from East King County.

The substantial increase in roadway capacity provided in Alternative 4 could result in shifts in land use patterns and study area trip making. A test was made to determine the land use effects of the improved accessibility provided by Alternative 4. The *I-405 Corridor Program Draft Land Use Expertise Report* (DEA, 2001) documents the results of this analysis, which showed that Alternative 4 causes clustering of development patterns within the study area and could result in additional growth pressures within the Urban Growth Area. This would have an overall positive effect on reducing trip lengths in the I-405 corridor, although this effect was not directly measured. In the short run after implementation (prior to 2020), the substantial improvement in mobility provided by Alternative 4 could result in an increase in the number of discretionary trips made within the corridor. By 2020 and beyond, these effects are expected to be minimal in comparison with the high growth in overall study area and regional trips produced.

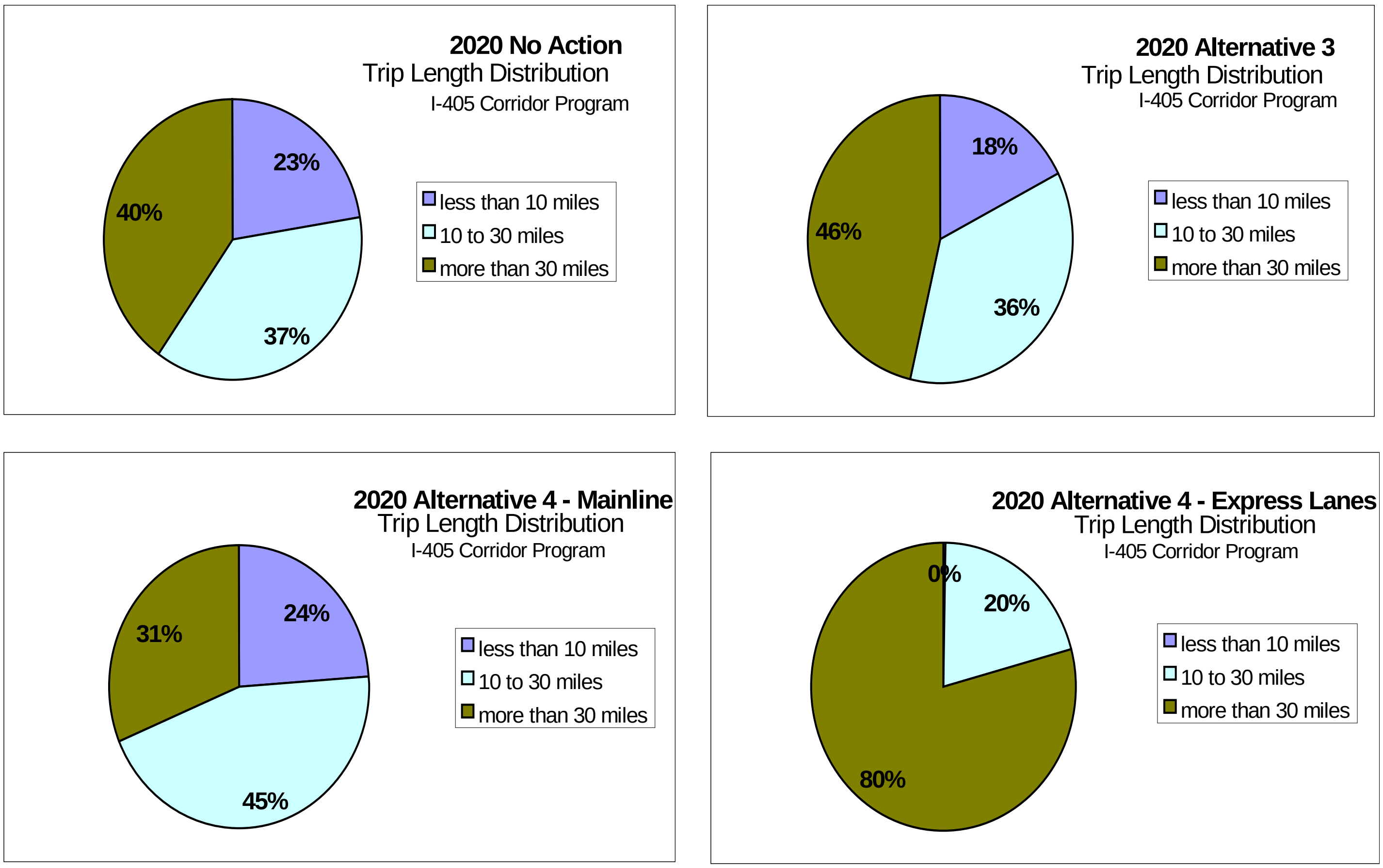
Alternative 4 results in changing trip patterns and mobility within the study area that contribute to an increase in trip lengths along I-405. **Figure 4-25** shows that over 90 percent of the added trips on I-405 (compared to No Action) would have trip lengths in excess of 10 miles, with over 50 percent more than 30 miles in length. In contrast to Alternative 3, Alternative 4 provides a more balanced distribution of trip lengths. This is due to the combination of adding general capacity to the I-405 mainline (to serve more local trips), together with the express roadway serving long trips (i.e. around 80 percent being longer than 30 miles in length).

Table 4-52: Sources of Traffic Volume Shifts to I-405 – Alternative 4

Source	Alternative 4	Percent
I-405	*105,000*	
Seattle I-5/SR 99	40,000.00	38%
Study Area North-South Arterials	12,000.00	11%
East King County Arterials	8,000.00	8%
Study Area Travel Patterns	45,000.00	43%

Source: PSRC

Figure 4-25: Trip Length Distributions for I-405 - Alternative 4



Source: PSRC Model, Parsons Brinckerhoff

4.6.1.2 Criterion: Improve Reliability of Travel Times for All Modes

This criterion is measured by analyzing the predictability of the travel time in the corridor for general traffic, HOV, transit, and freight. Nonmotorized modes were not analyzed.

4.6.1.2.1 Effects on Travel Time Reliability by Mode

Among the Build Alternatives, Alternative 4 provides the best reliability for general traffic travel and is significantly better than the conditions under No Action. Most segments of I-405 would be reconstructed to add one additional travel lane plus a four-lane express way. Current design standards would be used to design the roadway facilities. The express roadway could be designed to operate with high levels of service to minimize travel time delays. Average levels of traffic congestion for this alternative are much better than No Action. General-purpose traffic, including freight, would benefit from these improvements.

Construction of the express lane would be the most time consuming among the Alternatives and would impact the capacity of the existing roadways most during the construction period. Innovative construction techniques would help maintain reliability during these periods.

Transit would continue to operate in the HOV lanes. The transit travel time reliability could be maintained at the existing levels, depending on how the managed to avoid overcrowding. HOV 3+ reliability would benefit from the addition of HOV freeway-to-freeway ramps.

4.6.1.3 Criterion: Provide Flexibility to Accommodate Post-2020 Travel Demands

This criterion is measured by looking at the future flexibility of the Alternatives using the following measures:

- Available Capacity at 2020
- Potential for Adaptability

4.6.1.3.1 Available Capacity at 2020

Alternative 4 would have available capacity remaining after 2020. Alternative 4 could accommodate 2020 person demands that are up to 30 percent higher than No Action conditions, and equal or greater than the theoretical unconstrained demand. This capacity is created by the equivalent of 3 general-purpose lanes added in each direction along I-405. Transit capacity increases would keep pace with corridor growth, but would provide minimal excess capacity after 2020.

The expansion of I-405 with Alternative 4 could greatly reduce traffic congestion on I-405 in 2020. However, overall study area congestion would still be similar to current traffic conditions. By 2030, however, daily traffic volumes within the study area would use up most of this available capacity for further person volume growth within the corridor.

4.6.1.3.2 Potential for Adaptability

The I-405 capacity expansion would provide the opportunity to manage the express roadway for different user groups. An example would be a High Occupancy Toll (HOT) facility. Any additional expansion of I-405 could not be readily accommodated without major redesign or property acquisition. The alternative includes several applications of Intelligent Transportation Systems (ITS) that will continue to maximize the efficiency of the current system.

4.6.1.4 Criterion: Reduce Travel Times for All Modes Door-to-Door Compared With Current Conditions

This criterion is addressed by the following performance measures.

- General traffic travel times

- HOV travel times
- Transit travel times

The door-to-door travel times for seven typical trips under Alternative 4 are compared with the No Action conditions. **Table 4-53** shows the travel times (with facility improvements) in Alternative 3 for general-purpose traffic and HOV (carpools and vanpools) modes. **Table 4-54** shows the transit travel times (with facility improvements) of Alternative 4. Two types of access were analyzed: walk-and-ride and park-and-ride.

4.6.1.4.1 General-purpose Traffic

Alternative 4 would reduce travel times for general-purpose traffic significantly compared to No Action travel times. The time reductions for the seven trips range from 8 to 14 minutes, improving 11 to 20 percent from the No Action travel times.

Alternative 4 shows the largest amount of general-purpose traffic travel time among the Build Alternatives. The general traffic travel times under Alternative 4 would remain 3 to 11 minutes longer than 1995 travel times. However, for trips focussed directly along I-405, such as Bellevue CBD to Federal Way/Kent, Renton to Mill Creek, and Bellevue CBD to Edmonds/Lynnwood, travel times could be expected to improve similar to, or better than, current travel times.

4.6.1.4.2 HOVs

The travel time for HOVs (3+) under the Alternative 4 conditions would not change substantially from No Action. There may be a one to two minute travel time reduction for certain trips.

4.6.1.4.3 Transit

The transit travel time improvements in Alternative 4 are relatively modest. For both walk-and-ride access and park-and-ride access, the transit travel times under this alternative would be shorten by one to nine minutes, compared with No Action. Most of the trips show four to five minutes of travel time savings. The largest travel time reductions (up to 9 minutes)would occur on the north-south trip from Renton to Mill Creek. The trip from Issaquah to Bothell/Kenmore would show six to seven minutes of travel time savings.

Table 4-53: General and HOV Traffic PM Peak Travel Time Comparisons Between 2020 No Action and Alternative 4

	General Traffic* Travel Time (Minutes)			HOV (3+) Travel Time (Minutes)		
Trips	**No Action**	**Alt. 4**	**Difference**	**No Action**	**Alt. 4**	**Difference**
Bellevue CBD to Federal Way/Kent	79	65	-14	42	41	-1
Renton to Mill Creek	84	71	-14	51	50	0
Bellevue CBD to Edmonds/Lynnwood	55	45	-11	36	37	0
Tukwila/Sea-Tac to Redmond/Overlake	61	52	-10	42	42	0
Issaquah/Cougar Mount. to Bothell/Kenmore	62	54	-8	45	45	-1
Issaquah/Cougar Mount. to Federal Way/Kent	74	67	-8	51	51	-1

Single occupant vehicle; 2-person carpools, trucks
Source: PSRC Model

Table 4-54: Transit PM Peak Travel Time Comparisons Between 2020 No Action and Alternative 4

	Transit Travel Time with Walk-and-Ride Access (Minutes)			Transit Travel Time with Park-and-Ride Access (Minutes)		
Trips	**No Action**	**Alt. 4**	**Difference**	**No Action**	**Alt. 4**	**Difference**
Bellevue CBD to Federal Way/Kent	95	92	-2	85	83	-2
Renton to Mill Creek	126	117	-9	112	104	-8
Bellevue CBD to Edmonds/Lynnwood	84	79	-4	73	68	-5
Tukwila/Sea-Tac to Redmond/Overlake	116	112	-3	102	101	-1
Issaquah/Cougar Mount. to Bothell/Kenmore	114	107	-7	104	98	-6
Issaquah/Cougar Mount. to Federal Way/Kent	130	125	-5	119	114	-5

Source: PSRC Model

4.6.1.5 Criterion: Reduce the Share of Peak Period and Daily Trips by Single Occupant Vehicles

This criterion is measured by analyzing the following performance measures:

- Modal Shares
- Transit Riders
- TDM

4.6.1.5.1 Modal Shares

Percentage of Peak Period Persons Choosing Modes of Travel at 3 Screenlines

This performance measure summarizes the percentage of PM peak period persons utilizing alternative modes (HOV 3+ and transit) at each of three screenlines (refer to Figure 4-1 for screenline locations). Figures 4-13 through 4-15 depict the HOV and transit person trips and mode shares at the screenlines.

HOV (3+)

Without specific TDM strategies, HOV usage in Alternative 3 is very similar to the No Action conditions. However, the share of person trips is lower, as shown in Figures 4-13 through 4-15. This trend is especially apparent in Figure 4-15 at the Bellevue and Renton screenlines. This situation is caused by a 30 to 40 percent increase in total person trips created by the addition of the equivalent of three lanes of general-purpose capacity in each direction on I-405. Most of the total person trip increase is in non-HOV modes.

The TDM program effects in Alternative 4 would be similar to the one in Alternative 2. It is estimated that the combination of additional vanpools and carpooling incentives could result in up to a 10 percent increase in HOV (3+) mode share compared to the results shown above.

Transit

Without specific TDM strategies, the transit share of usage at the Bothell screenline would remain at approximately 1 to 2 percent of total PM peak period person trips. At the Bellevue screenline, peak period transit usage would increase by around 10 percent compared to No Action. However, the transit mode share at the Bellevue screenline decreases from 3 percent (No Action) to 2 percent (Alternative 4) due to the large increase in non HOV/Transit persons using the express roadway element of this alternative. At the Renton screenline, peak period transit usage stays about the same compared to No Action, while the transit mode share decreases to about 1 percent for the same reasons cited at the Bellevue screenline.

Alternative 4 contains substantial TDM strategies to encourage and support transit use. It is estimated that these incentives could result in a 20 to 30 percent increase in peak period transit usage and mode share compared to the results shown.

Single Occupant Vehicle Trip Reduction

Taken as a whole, the transit and TDM strategies contained in Alternative 4 could result in a reduction of peak period SOV trips in the 10 percent range. These effects are comparable with the results of Alternatives 2 and 3.

Shares of Study Area Work Trips

This measure indicates the mode of travel chosen by workers within the study area. Most work trips occur during the peak periods and comprise around a quarter of total daily trips. The mode split of daily work person trips in Alternative 4 is similar to Alternative 1. Overall work transit trips are somewhat lower than in Alternative 1, but are 10 percent higher than No Action. HOV usage is similar to No Action.

4.6.1.5.2 Transit Riders

PM Peak Period Transit Riders Along Key Segments

Alternative 4 does not include a High Capacity Transit element.

4.6.1.6 Criterion: Provide Effective Connections to Regional and Local Transportation Systems

This criterion is measured by looking at the following performance measures:

- Compatibility with regional systems
- Compatibility with local systems
- Accessibility to various mode choices.

4.6.1.6.1 Compatibility with Regional Systems

Alternative 4 would connect the existing I-405 HOV lanes with the regional HOV system using direct freeway-to-freeway HOV ramps. This alternative would not construct a regional HCT system connecting the urban centers. Therefore, while the compatibility with the regional HOV system is better than No Action, the compatibility with the regional transit system would not be as good as Alternative 1 or Alternative 2.

The new express lanes would be connected with the regional freeways by new ramps. Those ramps would be designed to accommodate the increased travel demands in the I-405 corridor and would provide adequate capacity. The capacity of other freeways connecting to I-405 would be expanded to match the increased capacity of I-405. The compatibility with the regional general-purpose traffic systems would much better than No Action. General-purpose traffic, including truck movement, would be enhanced.

4.6.1.6.2 Compatibility with Local Systems

Overall, this alternative would have high levels of compatibility with local transportation plans.

Under this alternative, actions would be taken to improve the arterials connecting with I-405 and the I-405 interchanges. Those improvements are designed to match the added capacity on I-405 with arterial and ramp capacity. Many of the existing and anticipated incompatibility problems would be addressed with the proposed improvements in this alternative. Again general-purpose traffic, including freight movement, benefits from improved mobility.

Since most of the arterial improvements in this alternative have been adopted in the local transportation plans, actions to implement those improvements would make this alternative more compatible with local transportation plans. Some additional arterial projects would have to be integrated into local plans.

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4.6.2 Objective – Reduce Congestion

4.6.2.1 Criterion: Reduce Congestion on Study Area Freeways and Arterials Below Current Levels

This criterion is addressed by examining the following performance measures:

1) Hours of Traffic Congestion

- Hours of congestion in each segment of I-405 and arterial segments in a typical day
- Hours of congestion aggregated within the study area by freeway and arterial functional classification

2) Vehicles Miles and Hours of Travel

- Study area and region-wide daily vehicle miles of travel
- Study area and region-wide daily vehicle hours of travel

4.6.2.1.1 Hours of Traffic Congestion

<u>**Hours of Congestion in Each Segment of I-405 and Within the Study Areas**</u>

Hours of traffic congestion with facility improvements in Alternative 4 are same or slightly less than Alternative 3. Hours of congestion would substantially improve over No Action as shown in **Table 4-55**.

The section of I-405 from NE 85th Street to NE 124th Street would operate with five hours of congestion, where it operates with 13 hours of congestion today. Several segments on I-405 south of I-90 would continue to operate with more than 10 hours of traffic congestion under Alternative 4. The most congested I-405 segment under Alternative 4 would be from NE Park Drive to I-90, because the expanded capacity would attract more demand than the system could carry. The duration of traffic congestion would be longer than under the existing conditions.

The average hours of congestion on I-405 would be cut from seven to four hours under Alternative 4, a major improvement from the No Action and better than current conditions on the freeway. The hours of congestion for other freeways would be reduced by one or two hours. Arterial congestion would decrease by one hour compared with No Action conditions.

On a systemwide basis, Alternative 4 would reduce congestion five hours to four hours, which is similar to current conditions.

Table 4-55: Hours of Traffic Congestion by I-405 Segments for No Action and Alternative 4

I-405 Segment	1999 Existing	No Action (hours)	Alternative 4 (hours)	Difference (Alternative 4-No Action)
I-5 to SR 167	12	13	10	-3
SR 167 to NE Park Dr.	10	14	9	-5
NE Park Dr. to I-90	10	11	13	+2
I-90 to SR 520	9	8	4	-4
SR 520 to NE 85th Street	5	5	5	0
NE 85th Street to NE 124th Street	13	5	5	4
NE 124th Street to SR 522	4	8	5	-3
SR 522 to I-5	5	6	2	-4
Average of I-405	**7**	**7**	**4**	**-3**
Average of Other Freeways	**3**	**5**	**3**	**-2**
Average of Arterials	**3**	**5**	**4**	**-1**
Average of All Facilities	**4**	**5**	**4**	**-1**

Source: PSRC Model, Mirai Associates

4.6.2.1.2 Vehicles Miles and Hours of Travel

Study Area and Region-wide Daily Vehicle Miles, Hours of Travel, and Speeds

Table 4-56 summarizes the changes in study area and regional daily VMT and VHT for Alternative 4 compared to for the No Action Alternative. Before the effects of TDM strategies are considered, the study area VMT would increase by up to 16 percent (+2% regionally). Although study area VHT would increase by around 2 percent, regional VHT would decrease. The TDM program was estimated to reduce daily VMT by 3 to 6 percent. This reduction would tend to offset part of the VMT increases created primarily by the substantial added capacity provided on I-405 and arterial routes. Changes in VHT due to the TDM program were not directly estimated, but could be considered to show similar trends to those shown for VMT reductions.

Table 4-56: Study Area and Region-wide Daily VMT and VHT for Alternative 4

	VMT (Daily)		VHT (Daily)	
Alternative	**Study Area (trips within)**	**Region-wide**	**Study Area (trips within)**	**Region-wide**
1995	16,346,000	69,412,000	586,000	2,295,000
2020 No Action	22,510,000	100,571,000	1,156,000	3,948,000
2020 General Capacity (Alt.4)	26,208,000	102,730,000	1,184,000	3,903,000
Change vs. No Action (%)	16.4%	2.1%	2.4%	-1.14%
Change vs. 1995 (%)	60.3%	48.9%	102.0%	70.1%
TDM Incentives Program	-3.0-6.0%	NA	NA	NA

Source: PSRC Model, WSDOT Urban Mobility Office

Average speeds are portrayed in **Table 4-57**. Since I-405 and study area VMT increase much more than VHT under this alternative, there is a substantial improvement in overall vehicle speeds within the corridor. Regional average speeds improve slightly during all daily time periods.

Table 4-57: Average Travel Speeds- Alternative 4

	Average Speed -MPH (AM Peak Period/PM Peak Period/Daily)		
Alternative	**I-405**	**Study Area (Trips Within)**	**Region-wide**
2020 No Action	34/25/31	26/13/19	29/20/25
Alternative 4	44/34/41	29/14/22	30/21/26

Speeds in Miles per Hour
Does not include TDM effects
Source: PSRC Model

4.6.2.1.3 Concurrency Impacts

Alternative 4 would perform similar to Alternative 3 with regard to addressing the concurrency problems facing local jurisdictions. With the identified facility investments on I-405 and the arterial system, the resulting levels of traffic congestion will be improved and local jurisdictions will be better able to manage their concurrency problems. Since Alternative 4 would likely require the longest implementation time, the concurrency issues may not be substantially addressed for several years.

4.6.3 Objective – Improve Safety

4.6.3.1 Criterion: Improve the Safety for All Modes Above Current Levels

This criterion is addressed by examining the following performance measures for safety issues:

- Potential for traffic accident reduction along high accident locations
- System Level Effects
- Potential for improving safety for transit vehicles
- Potential for reducing conflicts between vehicles, pedestrians, and bicycles

4.6.3.1.1 Potential for Traffic Accident Reduction Along High Accident Locations

This performance measure examines identified High Accident Locations (HAL's) documented within the study area by WSDOT and local agencies.

Table 4-58 summarizes the total number of safety improvements for I-405, I-5/I-90, and state routes within the study area. In general, there were a total of 60 HAL's identified. Alternative 4 would improve 37 of the identified HAL's, including over 80% of those identified along I-405.

Table 4-58: Safety Improvements for Freeways and State Routes - Alternative 4

Facility	HAL Totals	No Action		Alternative 4	
		Total	%	Total	%
I-405	30	3	10%	25	83%
I-5, I-90	3	0	0%	1	33%
State Routes	27	6	22%	11	41%
Total	**60**	**9**	**15%**	**37**	**62%**

Source: Mirai Associates

Table 4-59 summarizes the total number of safety improvements for unincorporated King County and city streets within the study area. Each jurisdiction had a separate approach in identifying HAL's, and, therefore, unincorporated King County and city streets were judged separately than the freeways and state routes, which were accounted for and analyzed by WSDOT. In general, there were a total of 47 HAL's identified. Alternative 4 would improve nine of the identified HAL's.

Table 4-59: Safety Improvements on Local Jurisdiction Streets - Alternative 4

Facility	HAL Totals	No Action		Alternative 4	
		Total	%	Total	%
Unincorporated King County and City Streets	47	3	6%	9	19%

Source: Mirai Associates

4.6.3.1.2 System Level Effects

An analysis of system-level accident effects was conducted within the I-405 study area. The system-level analysis considered the following factors influencing traffic and safety:

- Type of Facility- Freeway, Arterial
- Facility Design Characteristics- Proportion of facility designed to standards
- Amount of Travel (measured by Vehicle Miles of Travel)
- Amount of Congestion
- Traffic Patterns

Table 4-60 provides vehicle miles of travel estimates for Alternative 4 compared to 2020 No Action conditions. Alternative 4 would result in an increase of study area VMT by approximately 20%, primarily along I-405.

Table 4-60: VMT by Facility Type in the Study Area - Alternative 4

Facility	No Action VMT (Millions)	Alternative 4 VMT (Millions)	Alternative 4 % Designed to Standard
I-405	3.95	7.55 (+ 90%)**	90%
Other Freeways	5.28	5.80 (+ 9%)**	60%
Arterials*	8.89	8.27 (- 7%)**	Not Applicable
Total	18.12	21.62 (+ 20%)**	

* Principal and Minor Arterials within the study area
**(percent change from No Action)
Source: PSRC Model, Mirai Associates

Design Standards: Two additional general-purpose lane plus basic improvements would be provided along the I-405 corridor. These improvements would significantly upgrade the percentage of I-405 that would be designed 'to standard'. The design standards of other study area freeways (e.g. SR 520, I-90, SR 167) were assumed not to change.

Percent Congested: The analysis of study area congestion produced estimates of what proportion of the vehicle miles of travel on each facility would be congested on a daily basis. The results in **Table 4-61** apply to Alternative 4 and No Action conditions.

Table 4-61: Summary of Alternative 4 and No Action VMT Congestion

Facility	No Action % VMT Congested	Alternative 4 % VMT Congested
I-405	94%	78%
Other Freeways	71%	62%
Arterials	63%	55%

Source: PSRC Model, Mirai Associates

Travel Patterns: The addition of two GP lanes on I-405 was estimated to have a substantial effect on regional travel patterns. From 30-40 percent of the added traffic on I-405 (including the express roadway) could shift form the I-5/SR 99 corridor. These trips would divert from facilities with similar accident rates and were removed from the total accidents associated with the I-405 Alternatives. Up to 15 percent of the trips are estimated to shift from arterial routes in East King County. These trips would result in a net accident reduction due to the better accident rates on freeways compared to arterials.

Using these data, an estimate of annual study area accidents was made, as follows in **Table 4-62**.

Table 4-62: Summary of Study Area Annual Accidents – Alternative 4

Alternative	Total Accidents (rates)	Injury Accidents (rates)	Fatal Accidents (rates)
No Action (2020)	13,900 (2.10)	8,340 (1.26)	56 (0.84)
Alternative 4	13,310 (1.79)	7,680 (1.04)	53 (0.71)

Rate: per million VMT; Fatal-per million VMT
Source: Mirai Associates

Accidents and accident rates with Alternative 4 could be expected to reduce slightly, despite the 20 percent increase in study area VMT that occurs with this alternative. While accidents would rise on I-405 due to significantly added volumes, there would be a reduction in arterial volumes and accidents, along with fewer accidents due to congestion. In summary, the improvement in accidents with Alternative 4 can be attributed to the shift of traffic from arterial routes to I-405 and the geometric improvements provided by the addition of up to three travel lanes plus the basic improvements package of actions along I-405. A greater percentage of total traffic now using the freeway system will result in a lower overall accident rate.

4.6.3.1.3 Potential for Improving Safety for Transit Vehicles

Transit vehicle and patron safety is affected by the degree of separation between modes and the provision of updated transit facilities. Alternative 4 provides limited improvements to park-and-ride lots and transit stations within the study area. However, transit service will continue to operate within mixed-mode environments within most of the study area. Transit safety will benefit from the completion of the core HOV system and committed HOV direct access projects and transit center projects as part of the No Action Alternative.

4.6.3.1.4 Potential for Reducing Conflicts Between Vehicles, Pedestrians, and Bikes

Alternative 4 would improve 8 of the 17 identified nonmotorized High Accident Locations (HAL's), as defined in the No Action Alternative. These results are shown in **Table 4-63**.

Table 4-63: Nonmotorized Safety Hazard Locations – Alternative 4

Shoulder Type	HAL Location Totals	Safety Improvement Totals			
		No Action		Alternative 4	
		Total	%	Total	%
No Sidewalk and No Paved Shoulder	6	0	0%	5	83%
No Sidewalk with Paved Shoulder	2	0	0%	1	50%
No Bike Lane and No Shoulder	9	0	0%	2	22%
Total	17	0	0%	8	47%

Source: Mirai Associates

Several other nonmotorized improvements (e.g. sidewalks, bicycle lanes) would be made as part of the planned and programmed arterial projects included in this alternative.

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4.6.4 Construction Impacts

The addition of six lanes of roadway capacity in the I-405 corridor in Alternative 4 would have substantial impacts on traffic compared to the other Alternatives because of the extensive use of grade- and barrier-separated alignments, especially in the southern segment between Tukwila and I-90. Downtown Bellevue would be less of a problem because the express lanes could be on BNSF right-of-way. However, overall there would be more lane miles of existing roadways that would be exposed to construction, which could extend for up to 15 years with completion around 2020. The higher costs and more extensive and complex designs would result in longer periods of traffic impacts during construction. Innovative construction techniques would help maintain reliability during these periods.

These results suggest that spillover traffic to parallel arterial routes would occur during construction. Parallel arterial facilities such as Coal Creek Parkway, Bellevue Way, 148th Ave, SR 202, and Lake Washington Boulevard would likely experience traffic increases. There would also be the potential for short-term increases in local street cut-through traffic to avoid construction-related traffic impacts. Implementation of an expanded TDM program and transit service would be essential to provide mobility choices to travelers during construction. The North-South arterial improvements included in Alternative 4 could also occur earlier (e.g., 2006-2012) in the construction period to provide some traffic relief to persons affected by the freeway construction.

Appendix F identifies anticipated construction impacts on traffic and transit/HOV mode shares resulting from the reduction of lane capacity along I-405. These results suggest that spillover traffic to parallel arterial routes would occur, along with an increase in daily work trips by transit and HOV. Implementation of an expanded TDM program and transit service would be essential to provide mobility choices to travelers during construction.

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4.6.5 Toll on Express Lanes

A sensitivity test was conducted for Alternative 4 assuming that the express roadway was converted into a toll facility. The purpose of the analysis was to determine if demand for the express roadway could be managed using a pricing mechanism. The test assumed that a toll would be charged on a per-mile basis, with varying rates during the AM, PM and off-peak periods. The analysis did not assume a variable rate by user type (e.g. HOV, freight, SOV), although this could certainly be an option. The analysis also did not include any fiscal estimates of toll revenues that would accrue from such an operation.

4.6.5.1 Estimating an Optimal Toll

An estimate was made for a range of optimal toll rates that could be applied to the Express Lanes under Alternative 4. In consultation with PSRC staff, a simplified procedure was adapted from the methodology suggested by ECO Northwest[1] and implemented by PSRC for an analysis of optimizing roadway pricing. These results were summarized in a Technical Memorandum, *General Capacity Alternative (Alternative 4) with Toll on Express Lanes (January 2001)*, **Appendix G.**

The pricing procedure translates a given toll into an equivalent travel time delay. This is a common approach used in modeling to account for the effects of pricing. PSRC staff internalized this concept by feeding the modified travel times (reflecting a travel time delay equivalent to the value of the toll) from the traffic assignment process back into the mode choice process for several income classes.

By assuming an average value for travel time, one can then associate an optimal toll rate (in cents per mile of travel) corresponding to the estimated “toll time” values. Based on a survey of the value of travel time estimated for similar studies across the country, an estimate of $7 to $ 8 per hour seemed reasonable for this study. This results in the production of the following toll rate estimates for the Express Lanes:

- 8 to 10 cents per mile for AM peak period;

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[1] “Puget Sound Regional Council Transportation Pricing Alternatives Study,” Technical Memorandum 3 prepared by ECO Northwest, February 19, 2000.

- 25 to 35 cents per mile for PM peak period; and

- 5 to 7 cents per mile for off-peak period.

The analysis did not estimate varying rates for heavy vs. light vehicles or for other classes of users. These tolls do not translate directly into achieving a certain quality of travel on the express lanes, although one objective of the methodology is to maintain reasonable travel flows on the lanes that are tolled.

4.6.5.2 Traffic Effects of Toll

The 2020 travel model was rerun using the tolls documented above. The tolls were translated into equivalent travel time delays, with the result that traffic volumes shifted from the toll facility back to other roadways. The general effects of these shifts are discussed in the following sections.

4.6.5.2.1 I-405 Effects

The effect of the tolls on the I-405 daily traffic volumes are shown in Table 1. Overall, the volumes on the express lanes would be reduced by 30-40 percent, or around 25,000-35,000 vehicles per day (vpd). A relatively small shift in volume would occur back to the mainline I-405, with volumes increasing by less than 10 percent. Overall daily volumes on I-405 would be reduced by about 10 percent (i.e. around 20,000 –30,000 vpd). The resulting volumes along I-405 with tolls would be similar to the volumes forecasted for Alternative 3.

4.6.5.2.2 Regional Effects

The effect of the tolls were examined across the study area and regional screenlines developed for the I-405 Corridor Program. Within the study area, screenline volumes typically dropped by 5 percent or less. This occurred for travel in the north-south as well as the east-west directions. There was a slight tendency for north-south volumes on major arterials to increase. More people would opt for the arterials in lieu of the toll facility.

The forecasts showed some diversion back to the I-5 corridor, although overall volume increases along Seattle screenlines were generally in the 1-2 percent range. The south end tended to show somewhat higher shifts to I-5, while volumes in the north end of Seattle changed very little.

These results would indicate that the effect of tolling the express roadway on I-405 would cause minimal changes in regional travel patterns or corridor demands. One conclusion could be that trips removed from the express roadway due to tolls would show up as shorter trips within the study area, or as trips rerouted to other destinations. Additional analysis of the toll sensitivities to travel behavior and trip patterns would be necessary should the toll concept be advanced further within the I-405 Corridor Program.

4.6.6 Secondary Impacts

Secondary impacts are reasonably foreseeable effects of an action that occur later in time or are further removed in distance from the direct effects of the proposal. Generally, these effects are induced by the initial programmatic action. Programmatic secondary impacts are expected to be limited and unlikely for the I-405 Corridor Program for several reasons:

- All of the I-405 Corridor Program action Alternatives are generally compatible with existing regional and local land use plans that have already addressed growth.
- A similar level of projected growth is expected to occur in the region, with or without the action Alternatives.
- Transportation projects, similar to I-405, are frequently built in response to population and / or employment growth.
- The I-405 Corridor Program study area is experiencing a high rate of population growth and land development that is increasing travel demand and congestion.

Secondary effects may be more detectable during project-level environmental analysis. Therefore, the potential for secondary effects will be analyzed in the future project-level environmental analysis, documentation, and review.

Table 4-64: Comparative Analysis of Alternative 4 Volumes on I-405 with and without Tolls

Location on I-405	2020 Alternative 4			2020 Alternative 4 w/Toll on Express			Mainline Change vs. Alt 4 No Toll	Express Lane Change vs. Alt 4 No Toll	Total Change vs. Alt 4 No Toll
	Mainline	Express	Total	Mainline	Express	Total			
South of SR 524	162,396		162,396	147,125		147,125	NA	NA	-9%
South of 228th St SE	123,257	74,780	198,037	134,034	47,021	81,055	9%	-37%	-9%
South of County Line	123,147	74,780	197,927	133,979	47,021	181,000	9%	-37%	-9%
South of NE 124th St	190,161	82,520	272,681	194,543	55,706	250,249	2%	-32%	-8%
North of NE 85th St	212,066	82,520	294,586	215,355	55,706	271,060	2%	-32%	-8%
South of NE 70th St	177,154	95,343	272,497	184,078	62,776	246,854	4%	-34%	-9%
South of Main St (Bellevue)	231,559	95,343	326,902	235,525	62,776	298,301	2%	-34%	-9%
South of SE 60th St	184,005	103,314	287,319	185,821	70,438	256,259	1%	-32%	-11%
South of SR 169	189,242	103,314	292,556	196,277	70,438	266,715	4%	-32%	-9%
East of SR 181	171,875	78,373	250,249	181,382	51,642	233,025	6%	-34%	-7%

5. References

BRW, Inc., March 1998, *Mobility Action Priorities: Eastside Transportation Partnership*. Final Report.

CH2M HILL. February 1989. *Alternatives Report: Eastside Transportation Program*. KJS Associates, Inc.

David Evans and Associates, Inc., and Mirai Associates. August 2000. *I-405 Corridor Program: Alternatives Report (Draft)*. Submitted to Washington State Department of Transportation. Bellevue, Washington.

DeCorla-Souza, Patrick. Spring, 2000. *Induced Highway Travel: Transportation Policy Implications for Congested Metropolitan Areas.* Transportation Quarterly, Vol 54.No.2., p.18. Eno Transportation Foundation, Inc., Washington D.C.

Eastside Jurisdictions (Renton, Bothell, Kirkland, Bellevue), Miscellaneous accident data records, 1995-1999.

Eastside Transportation Partnership. November 1989. *Recommendations: Eastside Transportation Program*.

Ishimaru, John M. and Mark E. Hallenbeck. March 1999. *Central Puget Sound Freeway Network Usage and Performance*, Washington State Transportation Center, University of Washington.

Metropolitan King County Council. May 10, 2000. KCCP-2000 Transportation Committee Draft Policy Recommendations.

Puget Sound Regional Council. May 25, 1995. *1995 Metropolitan Transportation Plan: The Transportation Element of VISION 2020, the Region's Adopted Growth and Transportation Strategy*.

Puget Sound Regional Council. May 28, 1998. *1998 Progress Report: 1995 Metropolitan Transportation Plan*.

Puget Sound Regional Council. 2000. *2001 Update Metropolitan Transportation Plan: Baseline Technical Report*.

Puget Sound Regional Council. March 15, 2001. *Draft Destination 2030: Metropolitan Transportation Plan for the Central Puget Sound Region, Executive Summary*.

Sound Transit. May 31, 1996. *Sound Move – The 10-Year Regional Transit System Plan*.

Washington State Department of Transportation. *Central Puget Sound Freeway Network Usage and Performance-1999 Update*, Volume 1, Draft, available in the Washington State Transportation Center internet web site. http://depts.washington.edu/trac/

Washington State Department of Transportation. 1999-2018. *The State Highway System Plan* (Second Printing).

Washington State Department of Transportation and Mirai Associates. August 1999. *I-405 Corridor Program: Relevant Transportation Plans, Projects and Programs* - Working Papers #12 and #26, Submitted to Washington State Department of Transportation.

Washington State Department of Transportation. Traffic Accident Database, 1994-1996. Obtained from WSDOT data office.

Other Technical Expertise Reports related to the EIS:

CH2M HILL. Revised August 2001. *I-405 Corridor Program Draft Cultural Resources Expertise Report.*

CH2M HILL. Revised August 2001. *I-405 Corridor Program Draft Economics Expertise Report.*

CH2M HILL. Revised August 2001. *I-405 Corridor Program Draft Environmental Justice Expertise Report.*

CH2M HILL. Revised August 2001. *I-405 Corridor Program Draft Geology and Soils Expertise Report.*

CH2M HILL. Revised August 2001. *I-405 Corridor Program Draft Groundwater Resources Expertise Report.*

CH2M HILL. Revised August 2001. *I-405 Corridor Program Draft Hazardous Materials and Wastes Technical Memorandum.*

CH2M HILL. Revised August 2001. *I-405 Corridor Program Draft Social Expertise Report.*

CH2M HILL. Revised August 2001. *I-405 Corridor Program Draft Surface Water Resources Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Fish and Aquatic Habitat Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Floodplain Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Land Use Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Land Use Plans and Policies Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Public Services Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Recreation and Section 4(f) Resources Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Right-of-Way and Displacements Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Shorelines Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Upland Vegetation, Habitat, and Wildlife Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Visual Resources Expertise Report.*

David Evans and Associates, Inc. Revised August 2001. *I-405 Corridor Program Draft Wetlands Expertise Report.*

HNTB Corporation, Inc. Revised August 2001. *I-405 Corridor Program Draft Utilities Expertise Report.*

Parsons Brinckerhoff. Revised August 2001. *I-405 Corridor Program Draft Air Quality Expertise Report.*

Parsons Brinckerhoff. Revised August 2001. *I-405 Corridor Program Draft Energy Technical Memorandum.*

Parsons Brinckerhoff. Revised August 2001. *I-405 Corridor Program Draft Noise Expertise Report.*

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6. Glossary

Arterials: A major street that primarily serves through traffic, but also provides access to abutting properties. Arterials are often divided into principal and minor classifications depending on number of lanes, connections made, volume of traffic, nature of traffic, speeds, interruptions (access functions) and length.

Average Vehicle Occupancy: The average number of persons in vehicles on given transportation facilities.

Bus rapid transit. An express, or limited stop, rubber-tired transit system operating predominately in roadway managed lanes (e.g. HOV 3+, HOT lanes, etc.)

Capacity: The maximum sustained traffic flow of a transportation facility, expressed in passenger cars per hour per lane, under prevailing traffic and roadway conditions in a specified direction.

Capacity-related Projects: Projects that increase the number of vehicles or people that can be served by a transportation facility.

Centers: Compact, well-defined areas to which a mix of higher density growth or intensive land uses will be directed, connected and served by an efficient, transit-oriented, multi-modal transportation system.

Central Business District (CBD): The downtown retail trade and commercial area of a city or an area of very high land valuation, traffic flow, and concentration of retail business offices, theaters, hotels, and services.

Collector Distributor Lanes: Freeway lanes serving single or multiple interchanges that are physically separated from general freeway lanes. The purpose of collector distributor lanes is to separate the through traffic from the traffic entering and exiting the freeway.

Commuter Rail: Railroad local and regional passenger train operations between a central city, its suburbs, and / or another central city.

Concurrence Points: Key milestones within a “Reinventing NEPA” process for which formal written concurrence must be received from participating agencies.

Concurrency. A provision of the Washington State Growth Management Act (GMA) that requires local jurisdictions to adopt and enforce ordinances precluding approval of a proposed development if that development would cause the level-of-service of a transportation facility to fall below the jurisdiction’s adopted standard, unless transportation improvements or strategies to accommodate the impacts of the development are made within six years (concurrent with) the development.

Congestion: A condition characterized by unstable traffic flows that prohibits movement on a transportation facility at optimal legal speeds. Recurring congestion is caused by constant excess volume compared with capacity. Nonrecurring congestion is caused by actions such as special events and / or traffic accidents.

Corridor: A broad geographical band that follows a general directional flow connecting major sources of trips that may contain a number of streets, highways, and transit route alignments.

EMME/2. Regional transportation model for the Puget Sound region.

Environmental Mitigation Measures: Measures taken to reduce adverse effects on the environment, which are usually implemented under the State Environmental Policy Act (SEPA) or the National Environmental Policy Act (NEPA).

ESA: Endangered Species Act

Express Lane: Physically separated freeway lanes with limited interchanges, typically no more than one every 3-4 miles.

General Purpose Lane (GP): A freeway or arterial lane available for use by all traffic.

Growth Management Act (GMA): Washington State legislation passed in 1990 and subsequently amended that requires long-range comprehensive plans prepared by cities and counties to be balanced with supporting transportation infrastructure (RCW 36.70A).

High Capacity Transit (HCT): Transit systems operating, in whole or part, on a fixed guideway dedicated right –of-way or freeway / express facility, designed to carry a large number of riders at higher speeds than conventional transit. Examples include express bus on HOV lanes, passenger ferry service, and light and heavy rail systems.

High Occupancy Vehicles (HOV): A vehicle carrying two or more people. The minimum number of vehicle occupants required to qualify for HOV lane use may vary depending on the congestion levels and capacity of the HOV lane and the surrounding road system.

HOT Lane: High Occupancy Toll Lane. Signifies a lane (typically on a freeway) that is managed to restrict use by different modes through the use of time-of-day tolls.

Induced travel. Increase in total VMT resulting from increased capacity excluding other effects such as population growth.

Intermodal. Accommodation or interconnection of various transportation modes both for the movement of people and goods.

Intelligent Transportation systems (ITS). The application of advanced technology to current transportation problems, including incident detection, signal coordination, real-time information, and other technology.

Jurisdiction: A municipal government agency such as a city or county. As appropriate, the term "jurisdiction" also includes federal and state agencies and federally recognized tribes.

Level of Service (LOS). A gauge for evaluating system performance for roadways, transit, non-motorized and other transportation modes. For example, roadway measures of level of service often assign criteria based on volume-to-capacity ratios.

Principal Arterial: A street classification which serves primarily long trips, connecting to freeways, and important activity centers. Free flow speeds typically range between 35 and 45 mph.

Metropolitan Transportation Plan (MTP): A detailed long-range plan for future investments in the central Puget Sound region's regional transportation system, including roads, transit, marine (state ferries), freight and goods, non-motorized transportation and aviation. For state planning purposes, the MTP is the region's Regional Transportation Plan.

Mitigation Measures. Actions taken to reduce adverse effects on the environment, usually implemented under the State Environmental Policy Act (SEPA) and/or the National Environmental Policy Act (NEPA).

Mode: A particular form of travel. Typically transportation modes include driving alone (single occupancy vehicle), carpooling (high occupancy vehicle), non-motorized (walking, jogging, skipping, hopping, biking), or riding transit or High Capacity Transit (light rail or commuter rail).

Mode Split: The percentage of persons using different travel modes typically described for autos, transit and non-motorized modes.

Modeling. Use of mathematical equations to simulate and predict real events and processes.

Multimodal: Concerning or involving more than one transportation mode.

NEPA: National Environmental Policy Act.

Non HOV: A 2 person car traveling in the general-purpose lanes when the HOV lane is HOV +3.

Non-Motorized. Generally referring to bicycle, pedestrian and other modes of transportation not involving a motor vehicle.

Peak Period. The period of the day during which the maximum amount of travel occurs. It may be specified as the morning (A.M.) or afternoon or evening (P.M.) peak, depending on the facility.

Principal Arterial. A street that serves primarily long trips, connecting to freeways and important activity centers. Free flow speeds typically range between 35 and 45 mph.

Puget Sound Regional Council (PSRC). The Metropolitan Planning Organization (MPO) and Regional Transportation Planning Organization (RTPO) for the central Puget Sound region. The MPO/RTPO is the legally mandated forum for cooperative transportation decision-making in a metropolitan planning area.

Screenline: An imaginary line crossing roadways and other transportation facilities, and used as a reference point for measuring or reporting travel volumes.

Single-Occupant Vehicle (SOV): A vehicle with only one occupant (i.e., the driver).

SEPA: State Environmental Policy Act: State legislation passed in 1974, which establishes an environmental review process for all development projects, and major planning studies, prior to taking any action on these projects. SEPA permits early coordination to identify and mitigate any significant issues or impacts which may result from a project or study.

Sound Move. Sound Transit's ten-year (1996 to 2006) Regional Transit System Plan for implementing commuter rail, light rail, and regional express bus services and HOV facility development in parts of Snohomish, King and Pierce counties.

Transportation Demand Management (TDM): Institutional and operational methods to reduce travel demand on the transportation system. TDM strategies are usually implemented to support the use of HOVs, and typically include carpool, vanpool, and public transit programs.

Transportation System Management (TSM): The application of construction, operational, and regulatory or legislative actions to provide the most cost-effective use of existing transportation facilities.

Unconstrained Person Volumes: The potential demand for persons traveling along a corridor without considering traffic congestion constraints.

Vehicle Miles Traveled (VMT). A measure of the extent of motor vehicle operation; the total number of vehicle miles traveled within a specific geographic area over a given period of time**.**

Vehicle Volumes: The number of vehicles on a roadway over a given period of time.

Vision 2020: The Puget Sound region's strategic growth management and transportation plan prepared by the Puget Sound Regional Council.

Volume Capacity (V/C): The ratio of vehicle volumes to roadway capacity typically used as an indicator of roadway level of service.

APPENDICES

A. Major Elements of Alternatives

B. Alternatives Project Matrix

C. Transportation Demand Management Memorandum

D. Freight Mobility Memorandum

E. ITS Corridor Plan

F. Construction Impacts Memorandum

G. Tolls on Express Lanes

H. Transportation Data

I. Communication and Coordination

APPENDIX A

Major Elements of Alternatives

Appendix A
I-405 CORRIDOR PROGRAM
MAJOR ELEMENTS OF ALTERNATIVES

1. TRANSPORTATION DEMAND MANAGEMENT

TDM Package Core Assumptions

- Existing TDM programs will continue (public & private sector)
- Existing public TDM programs will be expanded to meet new market demand
- Implementation of trip reduction targets will be supported by new interlocal or sub-regional agreements
- Strategies are flexible, monitored and adjusted as needed over time (includes tracking trends for Internet, e-commerce)
- Funding is provided for demonstration projects, plus some ongoing funding for new TDM strategies found effective

Focus of TDM Package

SOV and other trip reduction through the use of:

- Incentives
- Increasing access to alternative modes
- Public information, education and promotion
- Land use strategies

Strategies in the TDM Package

VANPOOLING
• Maximize vanpooling in the corridor (minimum of a five-fold increase)
   * Intensive marketing of vanpooling, including start-up subsidies
   * Use of new “value-added" incentives (e.g., frequent flyer miles for vanpoolers)
   * Creation of a revolving no-interest loan fund for purchasing vans
   * 50% fare subsidy
   * Provide sufficient infrastructure (e.g., small park & ride lots)
   * Owner-operated vanpool promotion

PUBLIC INFORMATION, EDUCATION & PROMOTION PROGRAMS • Establish ongoing public education and awareness program specific to the corridor (focus on issues and transportation alternatives) • Provide traveler information system(s), including interactive ridematch and transit information • Provide personalized trip planning assistance, including for transit

Strategies in the TDM Package
EMPLOYER-BASED PROGRAMS • Increase work choices Telecommuting, flextime, compressed work schedules, multiple shifts Proximate commuting (assigning employees to work sites close to home) Incentives to employers to offer work choices (e.g., tax credits) • For current commuter trip reduction program – new incentives and resources to help CTR-affected employers obtain CTR goals (e.g., grants, tax credits, staff support) • Expanded CTR-like program aimed at smaller employers plus those larger ones not affected by CTR laws (non-regulatory, voluntary based) • Support development and core operations of transportation management associations (TMA) • Parking cash-out program incentives and financing
LAND USE AS TDM Compact, mixed-use, non-motorized and transit friendly (re)development in target areas (urban centers, suburban clusters, key arterials, transit station areas, transit centers, park-and-ride lots) • Transit-oriented development (TOD) • Code changes, streamlining processes, local connectivity retrofitting projects to support (re)development • Programs (code assistance, design review support) to help jurisdictions and developers implement compact (re)development • New parking management programs
OTHER MISCELLANEOUS TDM PROGRAMS Innovative transit and vanpool fare media, incentives, demonstrations, matching funds, etc. [e.g., area-wide "Smart Card" (FlexPass) programs for Eastgate, downtown Bellevue, north Renton industrial area, Bothell business parks, Redmond, downtown Kirkland, Tukwila] • Non-commute trips TDM programs (research and demonstrations) • Other miscellaneous incentives (local and state tax credit programs, developer incentives)

2. EXPANDED TDM PACKAGE

Overview

This major element will include the range of regional pricing actions being evaluated by the PSRC. The potential impacts of the following actions will be examined in the context of the I-405 Corridor:

- Region-wide congestion pricing (RCP);
- Fuel taxes (revenue = RCP);
- Fuel taxes (revenue = 50% RCP);

- Mileage charge (revenue = RCP);
- Parking charges;
- High occupancy toll lanes.

2. NEW TRANSIT EXPANSION BY 50% WITHIN STUDY AREA

Transit service levels would be increased by 25% compared to the current King County 6-year plan, assumed to be in place by 2007.

Transit service levels would be increased by 50% compared to the current King County 6-year plan, assumed to be in place by 2007.

3. DOUBLE TRANSIT SERVICE WITHIN STUDY AREA

Overview

Transit service levels would be doubled compared to the current King County 6-year plan, assumed to be in place by 2007. The effects of I-695 on short-term transit service have not been assumed. Transit service coverage and design would also be revised to more closely match travel patterns within the study area. These revisions could include more center-to-center movements, connections between neighborhoods and centers, and development of an appropriate 'grid' transit system within the study area.

4. PHYSICALLY SEPARATED HIGH-CAPACITY TRANSIT (HCT)

Description

A high-capacity transit solution would be designed for the I-405 corridor. The exact technology of this solution would be determined in later studies, but could include busway, light rail, monorail, or similar mode that could operate at speeds of up to 70 mph. The HCT alignment would generally follow the I-405, SR 520 and I-90 freeway corridors in existing freeway, arterial, or railroad right-of-way. The key characteristic of this solution would be that it would have a dedicated alignment, removing it from congestion-induced delays. Bus service would be reconfigured to provide maximum accessibility to the HCT system.

Alternatives 1 and 2 assume a full-scale HCT within the corridor, likely using some form of rail technology. Alternative 3 assumes a bus rapid transit (BRT) concept, building on the existing freeway HOV system.

High Capacity Transit		
Jurisdiction	**Project ID***	**Projects**
Tukwila & Renton	T.HCT-1	HCT- SeaTac to Renton CBD
Renton	T.HCT-2	HCT-Renton CBD to NE 44th (Port Quendall)
Renton, Newcastle & Bellevue	T.HCT-3	HCT- NE 44th (Port Quendall) to Factoria
Bell & Issaquah	T.HCT-4	HCT – Factoria to Issaquah

High Capacity Transit		
Bellevue	T.HCT-5	HCT – Factoria to Downtown Bellevue
Bell & Redmond	T.HCT-6	HCT – Bellevue to Redmond
Bell & Kirkland	T.HCT-7	HCT – Bellevue to Totem Lake
Kirk, King Co. & Woodinville	T.HCT-8	HCT – Totem Lake to Bothell
Bothell & Sno Co.	T.HCT-9	HCT – Bothell to Lynnwood

High Capacity Transit Stations	
Sea-Tac	Sea-Tac
Tukwila	Southcenter
Tukwila & Renton	Tukwila (Longacres)
Renton	Downtown Renton
Renton	North Renton
Renton	Port Quendall
Bellevue	Factoria
Bellevue	Bellevue Transit Center
Bellevue	Bellevue Library
Bell & Kirk	SR 520/Northup Way
Kirkland	Downtown Kirkland (NE 85th Street)
Kirkland	Totem Lake
Woodinville	NE 145th Street
Woodinville	Woodinville
Bothell	NE 195th Street
Bothell	Canyon Park
Snohomish County	164th Street SW (Ash Way)
Bellevue	Eastgate
Bellevue	Lakemont
Issaquah	Issaquah
Bellevue	132nd Avenue NE
Bellevue	148th Avenue NE
Redmond	Overlake (NE 40th Street)
Redmond	Redmond/Town Center
Redmond	Bear Creek
Mercer Island	Mercer Island

6. ADD ARTERIAL HOV AND TRANSIT PRIORITY

Overview

Create lanes, intersection queue jumps and signals that provide priority to HOVs and transit on major arterials in the study area.

Arterial HOV		
Bellevue	R.HOV-36	Coal Creek Pkwy I-405 to Forest Drive
Bellevue	R.HOV-37	NE 8th Street I-405 to 120th Ave NE
Kirkland, Redmond	R.HOV-38	NE 85th St Kirkland Way to 148th Ave NE
Kirkland	R.HOV-39	NE 116th 98th Ave NE to 124th Ave NE
Kirkland	R.HOV-40	NE 124th 100th Ave NE to 132 Ave NE
Bothell	R.HOV-41	SR 527 From SE 228th St to SR 524
Renton	R.HOV-43	SR 169 - SR 405 to Riverview Park vicinity - HOV/Transit Preferential treatment.
Renton	R.HOV-44	SW 27th St Corridor in Renton - Oaksdale Ave to SR 167
Redmond	R.HOV-47	Avondale Rd from Novelty Hill Road to Avondale Way Construct SB HOV lane
Renton, King Co	R.HOV-48	SW 43 St (SR 167 to 140 Ave SE)
Renton	R.HOV-49	Logan Ave N / N 6 St (S 3 St to Park Dr)
Renton	R.HOV-51	Park Dr - Sunset Blvd (Garden Ave to Duvall Ave NE)
Kenmore	R.HOV-53	68 Ave NE (Smds Rd to SR 522) - Construct NB HOV lane
Redmond	R.HOV-55	Willows Rd (Redmond Wy to NE 124 St)
Kirkland, Bell	R.HOV-56	Lake Wa Blvd (SR 520 to Yarrow Bay) - SB HOV lane
Kirkland	R.HOV-57	NE 68 St/NE 72 Pl (I-4405 Vicinity) – Que Bypass
Bellevue	R.HOV-60	Bellevue Way - I-90 to South Bellevue Park and Ride

7. HOV EXPRESS ON I-405 WITH DIRECT ACCESS RAMPS

Overview

Complete the series of ramps connecting arterials and freeways directly to HOV lanes on I-405. This allows carpools, vanpools and buses to use the HOV lanes without weaving across other traffic. HOV direct access ramps have already been designed by Sound Transit in downtown Bellevue and Kirkland, and design studies are starting for HOV ramps in downtown Renton.

HOV Interchange Ramps (Direct Access)		
Tukwila	R.HOV-25	SR 5 I/C @ Tukwila Fwy to Fwy HOV ramps,
Renton	R.HOV-26	SR 167 I/C Fwy to Fwy HOV ramps,
Bellevue	R.HOV-27	SR 90 I/C Fwy to Fwy HOV ramps,
Bellevue	R.HOV-28	SR 520 Fwy to Fwy HOV ramps,
Bothell	R.HOV-29	SR 522 Fwy to Fwy HOV Ramps
Sno. Co.	R.HOV-30	SR 5 I/C @ Swamp Creek Fwy HOV ramps.
Kirkland	R.HOV-61	NE 85th
ST	R.HOV-101	I-405 @ Lind – HOV Direct Access
Newcastle	R:HOV-65	112th St SE (In-Line Station)

Committed HOV Projects		
Bellevue	HOV-01	I-405 at NE 4th/6th/8th (Bellevue)/Construct new HOV direct access at NE 6th, Improve arterial capacity at NE 4th/8th interchanges
Bellevue	HOV-02	I-90 (Eastgate)/New I-90 HOV direct access connection to P&R
Renton	R.HOV-32	Between Sunset and SR-900 /Park Ave interchange in Renton
ST	R:HOV-66	I-405 at 128th St/HOV direct access improvements
Renton	R.HOV-33	NE 44th I/C - HOV Direct Access and Arterial Improvements(Assumes Port Quendall)
WSDOT	HOV-14	I-405 (I-5 Swamp Creek to SR 527)/Construct NB and SB HOV lanes total 6 lanes
Bothell	R.HOV-62	SR 522 Campus Access
Bothell	R.HOV-63	SR 527 Flyer Stop
ST	HOV-102	Woodinville Arterial Enhancements/HOV arterial enhancements

8. ADD PARK-AND-RIDE CAPACITY TO MEET DEMAND

Overview

Provides additional park-and-ride capacity at existing locations and creates selected new lots based on forecasted transit and carpool demand. The locations initially identified for expansion are listed below. These locations will be refined during the evaluation process.

Park and Rides		
Renton	T.PR-3	Renton East Highlands new Park and Ride
Tukwila & Renton	T.PR-6	Tukwila Commuter Rail (Longacres)
King County	T.PR-5	140th Ave SE and Petrovitsky Rd Vicinity
King County	T.PR-8	SR 169 and 140th WY SE
King County	T.PR-9	Petrovitsky Rd and 157th Ave SE
King County	T.PR-10	140th Ave SE and SE 192nd
King County	T.PR-11	SR 515 and SE 208th
Kent & Renton	T.PR-12	SR 167 and SW 43rd
Kent & Renton	T.PR-13	SR 167 and 84th Ave
Redmond	T.PR-17	Willows Rd @ NE 100th
Redmond	T.PR-18	SR 202 @ NE 100th
Bellevue & Kirkland	T.PR-20	South Kirkland
Redmond	T.PR-21	Overlake
Bellevue	T.PR-22	South Bellevue
Bellevue	T.PR-23	Newport (112th Ave. SE)
King County	T.PR-24	NE 160th/Brickyard Rd
Bothell	T.PR-25	Canyon Park (I-405 and SR 527)
Tukwila	T.PR-30	Tukwila
Kirkland	T.PR-31	Houghton
Kirkland	T.PR-32	Kingsgate
Medina	T.PR-33	Evergreen Point
Bellevue	T.PR-34	Wilburton
King County	T.PR-35	Lakemont
Redmond	T.PR-36	Redmond
Redmond	T.PR-37	Bear Creek
Bothell	T.PR-38	Bothell
Kenmore	T.PR-39	Northshore
Kenmore	T.PR-40	Kenmore
Woodinville	T.PR-41	Woodinville
Mercer Island	T.PR-42	Mercer Island
Bellevue	T.PR-43	Eastgate

9. ADD TRANSIT CENTER CAPACITY TO MEET DEMAND

Overview

Expand existing transit centers and create new transit centers to accommodate increased transit service. The specific locations for expansion and new centers will be identified during the evaluation process. Alternatives 1, 2, and 3 will require transit center capacity to accommodate a significant increase in transit service, at designated HCT stations, and at feeder bus connections. A partial listing is below.

Transit Center Capacity		
Renton	T.TC-6	Downtown Renton
Bellevue	T.TC-8	Downtown Bellevue
Redmond	T.TC-9	Overlake
Redmond	T.TC-10	Redmond/Town Center
Kirkland	T.TC-12	Downtown Kirkland
Kirkland	T.TC-14	Totem Lake

10. BASIC I-405 IMPROVEMENTS

Overview

This major element fixes existing bottlenecks and locations with safety deficiencies along I-405.

Basic I-405 Improvement Projects		
Jurisdiction	**Project ID***	**Projects**
Renton	R.BI.1	SR 167 Interchange - Direct Connection with auxiliary lane SB SR 169 to SR 167
Kirkland	R.BI.2	Continue NB climbing Lane from NE 70th to NE 85th and continue as auxiliary Lane to NE 116th
Kirkland	R.BI.3	SB auxiliary Lane NE 124th to NE 85th
Bellevue	R.BI.4	I-90 / Coal Creek Interchange
Bothell, King Co, Kirkland	R.BI.5	SB SR 522 to 124th continue climbing lane as an auxiliary lane
Bothell	R.BI.6	NB auxiliary lane SR 522 to SR 527
Renton	R.BI.7	Kennydale Hill climbing lane - SR 900 to 44th - NB 900 to 30th, SB 44th - 30th
Bellevue	R.BI.8	I-90 to Bellevue SB HOV direct connection to I-90 west
Bellevue	R.BI.9	NB auxiliary lane I-90 to NE 8th
Bellevue	R.BI.10	Increase SR 405 to Eastbound SR 520 Ramp capacity
Renton	R.BI.14	NB Auxiliary Lane I-5 to SR 167
Various	R.FR-24	Improve interchange geometrics at all major truck routes (WB-20 Design Criteria)
WSDOT	R-55	I-405/SR 167 Interchange/Construct new southbound I-405-to-southbound SR 167 ramp modification.

11. ADD 2 GENERAL PURPOSE LANES EACH DIRECTION ON I-405

Add up to 2 general purpose lanes to I-405 through widening of the existing freeway. A design option is to create collector-distributor lanes in selected corridor segments (See Element 12).

12. PROVIDE COLLECTOR DISTRIBUTOR LANES ON I-405

Overview

Collector- Distributor lanes provide more time for traffic to safely enter or exit from roadway by providing lanes removed from general travel. This is being considered as a design option to handle the addition of one or two general purpose lanes in each direction along I-405 in certain sections. Collector-Distributor lanes have been included as parts of other elements.

13. ADD TWO EXPRESS LANES EACH DIRECTION ON I-405

Overview

This element consists of a four-lane express facility designed to operate with limited interchanges along the length of I-405. The express lanes would be physically separated from the rest of I-405 through the use of barriers. Certain segments could operate within the median of I-405, while other segments would need to be elevated, in tunnel, or on separate alignments.

The express lanes could operate as a general purpose facility or as a managed facility, such as a 'High Occupancy Toll (i.e. HOT) lane. Certain users could be allowed to use the express lanes for free, while other users could be allowed to 'buy-in' to available capacity. The capacity would be priced depending upon demand.

Express Lanes – 2 Lanes each Direction between Major Interchanges		
Jurisdiction	**Project ID**	**Projects**
Tukwila, Renton	R.TC-20	Add Express lanes - SR 5 Tukwila to SR 167
Renton	R.TC-21	Add Express lanes - SR 167 to SR 900 north Renton I/C
Renton, Newcastle, Bellevue	R.TC-22	Add Express lanes -SR 900 North Renton I/C to SR 90
Bellevue	R.TC-23	Add Express lanes - SR 90 to SR 520
Bellevue, Kirkland	R.TC-24	Add Express lanes - SR 520 to NE 70th
Kirkland	R.TC-25	Add Express lanes - NE 70th to NE 124th
Kirkland, King County, Bothell	R.TC-26	Add Express lanes - NE 124th to SR 522
Bothell	R.TC-27	Add Express lanes - SR 522 to SR 527
Bothell and Snohomish Co.	R.TC-29	SR 527 to vicinity of Damson Road
Renton	R.TC-28	Add Express lanes- on SR 167 north of 180th up to I-405

Express Lanes –Access Locations		
Snohomish Co	R.TC-30	Northern end to Express lanes - Between SR 527 and I-5
King Co/Kirkland	R.TC-31	Slip Ramp- South of NE 160th St
Kirkland	R.TC-32	Slip Ramp- South of NE 70th St
Bellevue, Newcastle	R.TC-33	Slip Ramp- South of Coal Creek Pkwy
Renton	R.TC-34	Interchange access location- SR 167

14. WIDEN SR 167 BY 1 LANE EACH DIRECTION TO KENT (STUDY AREA BOUNDARY)

Overview

SR 167 would be widened by one lane in each direction to accommodate additional demands due to growing demands and the effects of improvements at the I-405/SR 167 interchange. The widening is assumed to extend at least to the study area boundary in Kent. Alternative 3 will consider the potential to add a total of two lanes in each direction to SR 167 within 1 mile of I-405, due to the substantial capacity additions assumed for I-405. This element does not presume that SR 167 would be redesignated as I-405, although each of these improvements would be compatible with such a redesignation if it occurs.

16. IMPROVE CONNECTING FREEWAY CAPACITY TO I-405

Overview

Enhance the capacity of connecting freeways by one lane in each direction (for a distance of approximately ½ to 1 mile on both sides of I-405) to avoid bottlenecks at the connections to I-405.

Connecting Freeway Capacity (One Lane, Each Direction)		
Jurisdiction	**Project ID**	**Projects**
Tukwila	R.CF.1	SR 518 I-405 to SR 99/Airport Access
Bellevue	R.CF.3	I-90 South Bellevue to Eastgate
Bellevue	R.CF.4	SR 520 Bellevue Way to 148th Avenue NE
Bothell, Woodinville	R.CF.5	SR 522 Bothell to NE 195th
Snohomish Co, Lynnwood	R.CF.6	SR 525 I-405 to SR 99
Renton, Kent	R.CF.8	SR 167 I-405 to Study Area Boundary
Tukwila	R.CF.9	I-5 at Tukwila
Lynnwood	R.CF.10	I-5 at Swamp Creek – 196th to 164th

17. IMPLEMENT PLANNED ARTERIAL IMPROVEMENTS

Overview

This major element involves the implementation of several arterial improvements called for in local agency plans and the Eastside Transportation Program (ETP). The ETP has been an ongoing process by regional, county and local governments to coordinate transportation planning and funding in East King County. Many of the ETP projects have already been examined in detail by the agencies involved and have been determined to be effective in addressing a variety of transportation issues.

Eastside Transportation Projects - Committed Projects		
Jurisdiction	**Project ID**	**Projects**
Bellevue	R-08	NE 29th Pl (148th Ave NE to NE 24th St)/Construct new 2-lane road
Bellevue	R-101	150th Ave SE---Widen to 7 lanes from SE 36th to SE 38th; add turn lanes
KCDOT	R-40	Juanita-Woodinville Way (NE 145 St to 112th Ave NE) Widen to 5 lanes + CGS, walkway/pathway
KCDOT	R-47	NE 124 St (Willows Rd to SR 202)--- Widen to 4/5 lanes + CGS, bike facilities; traffic signal.
Kirkland	R-21	NE 120 St (Slater Ave to 124 Ave NE)--- Construct new 3-lane roadway with ped/bike facilities
Redmond	R-111	Willows Rd Corridor Improvements-- Channelization of Willows Rd/Redmond Way intersection and widening of Willows Rd from NE 116th to NE 124th
Redmond	R-26	NE 90 St (Willows Rd to SR 202)--- Construct new 4/5 lanes + bike facilities
Redmond	R-28	West Lake Sammamish Parkway (Leary Way to Bel-Red Rd)--- Widen to 4/5 lanes + CGS, bike lanes
Renton	R-36	Oakesdale Ave SW (SW 31st to SW 16th)--- Construct new 5 lane roadway with CGS
Snohomish Co.	R-10	SR 524 (24 St SW to SR 527)--- Widen to 4/5 lanes including sidewalks, bike lanes
Snohomish Co.	R-117	39th Ave SE Realignment at SR 524 and York Rd--- Construct 4-way intersection to replace 2 offset intersections
Bothell, Snohomish Co.	R.AC-21	120th NE/39th SE - NE 95th to Maltby Rd - 4/5 lanes including new connection
Woodinville	R-51	Woodinville-Snohomish Rd/140 Ave NE (NE 175 St to SR 522)--- Widen to 4/5 lanes + CGS, bike lanes
Woodinville/ WSDOT	R-25	SR 202 Corridor Improvements(East Lake Sammamish Pkwy to Sahalee Way)--- Widen to 3/5 lanes; intersection improvements with bike/ped facilities
KCDOT	R-39	140 Ave SE (SR 169 to SE 208 St)--- Widen to 5 lanes SR 169 to SE 196 St, widen for turn channels on SE 196. Combines 2 King County CIP projects. A major North-South arterial which serves the Soos Creek Plateau and Fairwood.

Eastside Transportation Projects - Planned Projects		
Jurisdiction	**ETP #**	**Projects**
Bellevue	R.PA-2	148 Ave SE (SE 24 St to SE 28 St) New SB lane from SE 24 St to the WB I-90 on-ramp (ETP 203)
Bothell	R.PA-3	SR 522 Multimodal Corridor Project--- Widen SR-522 mostly within existing ROW to provide transit lanes, safety improvements, consolidated driveways & left turn lanes; and sidewalks. (ETP R-107)
Bothell	R.PA-4	SR 524 (SR 527 to Bothell City Limit)--- Widen to 5 lanes + CGS, bike facilities (class III) (ETP R-11)
KCDOT	R.PA-5	SE 212 Way/SE 208 St (SR 167 to Benson Rd/SR 515)--- Widen to 6 lanes + bike facilities, Transit/HOV preferential treatment, turn channels. (ETP R-46)
KCDOT	R.PA-8	NE 124/128 St (SR 202 to Avondale Rd)--- Widen to 4/5 lanes including bike & equestrian facilities (ETP 164)
KCDOT	R.PA-10	NE 132 St Extension (132 Ave NE to Willows Rd Ext.)---- Construct new 3 lane arterial with CGS, bike lanes (ETP 61)
Kenmore/KCDOT	R.PA-11	68 Ave NE (Simonds Rd to SR 522)--- Construct NB HOV lane total of 5/6 lanes (ETP 22)
Kirkland	R.PA-12	124 Ave NE (NE 85 St to Slater Rd NE)---- Widen to 3 lanes (s. of NE 116th St, 5 lanes n. of NE 116th St with ped/bike facilities (ETP R-23)
Kirkland	R.PA-13	NE 132 St (100 Ave NE to 116 Way NE)--- Widen to 3 lanes + CGS, Bike lane (ETP R-124)
Kirkland	R.PA-14	NE 100 St (117 Ave NE to Slater Ave) --- Construct bike/pedestrian/emergency Vehicle overpass across I-405 (ETP 309)
Newcastle	R.PA-15	Coal Creek Pkwy (SE 72 St to Renton City Limits)--- Widen to 4/5 lanes + CGS, bike lanes, traffic signals (ETP R-24)
Redmond	R.PA-16	Redmond 148th Ave NE Corridor - 3 projects--- Turn lane and channelization improvements along corridor – BROTS; (ETP R-112)
Redmond	R.PA-17	Bear Creek Pkwy--- Construct new 162nd Ave NE arterial and new 72nd St arterial w/ bike/ped and CSG; widen Bear Creek Pkwy (ETP R-110)
Redmond	R.PA-18	Union Hill Rd (Avondale Rd to 196 Ave NE)--- Widen to 4/5 lanes with bike facilities (ETP R-27)
Renton	R.PA-19	Duvall Ave NE (NE 4 St to NE 25 Court -City Limits)--- Widen to 5 lanes + CGS, bikeway (ETP R-31)
Renton	R.PA-20	Oakesdale Ave SW (Monster Rd to SR 900) Replace Monster Rd Bridge; widen to 4/5 lanes +Bike Lanes + CGS (ETP R-35)
Renton	R.PA-21	Rainier Ave / Grady Way (intersection)-- Grade separation (ETP R-33)

Eastside Transportation Projects - Planned Projects		
Renton	R.PA-22	SW Grady Way (SR 167 to SR 515)-- Rechannelize and modify signals for a continuous eastbound lane (ETP R-37)
Renton	R.PA-23	SR 167 at East Valley Road--- New southbound off-ramp and signalization at East Valley Road (ETP 255)
Renton/ KCDOT	R.PA-24	Soos Creek Regional Links --- Placeholder for Trans-Valley Study (ETP R-115)
Woodinville	R.PA-25	SR 522 Interchange Package(SR 522/SR 202 &SR522/195th St))-- Access improvements and new freeway ramps (ETP R-53) (See R.AC-30)
Woodinville	R.PA-26	SR202 Corridor Package (SR202/148th Ave & SR202/127th Place)--- Intersection improvements (ETP R-54)
WSDOT	R.PA-27	SR 520/SR 202 Interchange-- Complete interchange by constructing a new ramp and thru lane on 202 to SR 520 (ETP R-29)
WSDOT	R.PA-28	SR 202 / 140 Place NE (NE 124 St to NE 175 St)--- Widen 4/5 lanes (ETP R-43) (See R.AC-17, 18)

18. EXPAND CAPACITY ON NORTH-SOUTH ARTERIALS

Overview

This element expands arterial capacity to provide connected north-south travel. This element would facilitate vehicular movement without requiring as many trips along I-405.

North-South Arterial Projects		
King Co	R.AC-2	138th Ave - Petrovitsky Rd to SR 169- Add 1 lane
King Co, Renton	R.AC-3	138th Ave SE - Construct roadway link to 4/5 lanes- SR 169 to NE 4th St
Redmond	R.AC-15	Willows Rd- NE 90th St to NE 124th St- Add 1 lane each direction
King Co, Woodinville	R.AC-16	Willows Rd- NE 124th St to NE 145th St- construct new facility -4/5 lanes
Woodinville	R.AC-17	SR 202- NE 145th St to SR 522- widen to 5 lanes
Redmond, King County, Woodinville	R.AC-18	SR 202 - NE 90th to NE 145th
Bothell, Snohomish County, Mill Creek	R.AC-20	SR 527/Bothell Everett Hwy - SR 522 to SR 524 - Widen by 1 lane each direction
Bothell, Woodinville	R.AC-30	SR 202 connection across SR 522 to 120th
Tukwila	R.AC-35	SR 181- S 180th to S 200th
Tukwila	R.AC-36	SR 181- 144th to Strander Blvd.
Tukwila	R.AC-37	Southcenter Blvd - Tukwila Pky to Strander Blvd

19. UPGRADE ARTERIAL CONNECTIONS TO I-405

Overview

This element provides for upgrading arterial connections to I-405. These projects are intended to improve operations at on- and off-ramps as well as on the arterials themselves. An additional lane in each direction was assumed for these arterials, although further analysis may show that similar benefits could be achieved through selected intersection improvements in some cases.

Arterial Interchange Improvements (One Lane Each Direction)		
Jurisdiction	**Project ID**	**Projects**
Tukwila	R.IC-3	SR 181 West Valley Highway/ Interurban
Renton	R.IC-4	SR 169 Maple Valley Hwy SR 900 to NE 5th
Bellevue	R.IC-6	Coal Creek Pkwy I-405 to Factoria Blvd.
Kirkland, Redmond	R.IC-8	NE 85th St-Kirkland Way to 124th
Kirkland	R.IC-9	NE 116th- 114th Ave NE to 124th Ave NE
Kirkland	R.IC-10	NE 124th- 113th Ave NE to 124th Ave NE
Kirkland	R.IC-26	NE 132nd - 113th to 124th Ave NE
Bothell	R.IC-11	SR 527-228th to SR 524
Kirkland, King Co	R.IC-14	New half diamond interchange to/from north at NE 132nd St
Bothell	R.IC-21	New SR 405 Interchange at 240th Street SE(Bothell)
Bothell	R.IC-24	NE 160th Street-112th Ave to Juanita/Woodinville Way

21. CORRIDOR PEDESTRIAN AND BICYCLE IMPROVEMENTS

Overview

Non-motorized improvements throughout the corridor provide needed connections between modes (e.g. pedestrian overpasses from park and rides to freeway bus stops) and allow for commutes or trips to be made by walking or biking. Alternative 3 will exclude all of the 'long-distance' trails (identified below under the heading Pedestrian/Bicycle Connections) from this element. These improvements need further refinement in the context of other major elements in the alternatives.

Pedestrian/Bicycle (I-405 Crossings)		
Bellevue	NM. CR-1	Lk Washington Blvd/112th Ave. SE - crossing I-405 from 106th Ave. SE to 112th Place SE - Add sidewalks
Bothell	NM. CR-2	Fitzgerald Rd/27th Ave. - crossing I-405 from 228th St. SE to 240th St. SE - Add ped/bike facility
King County	NM. CR-3	SR-524 (Filbert Road) - crossing I-405 from North Rd to Locust Way - Add sidewalk/paved shoulder
King County	NM. CR-4	Damson Road - crossing I-405 from 192nd St SW to Logan Rd - Add sidewalk/paved shoulder
Renton	NM. CR-5	NE Park Drive - crossing I-405 from SR-900/Sunset Blvd to Lake Wash Blvd - Add sidewalk/paved shoulder
Renton	NM. CR-6	Jackson SW/Longacres Dr SW - crossing I-405 from S. Longacres Way to Monster Rd SW - Add sidewalk/paved shoulder
Bothell	NM. CR-7	Connection between Sammamish River Trail and North Creek Trail - between SR-522 and NE 195th St. - Add ped/bike over-crossing of I-405
Bothell	NM. CR-8	SR-527 - crossing I-405 from 220th St SE to 228th St SE - ped/bike facility

Pedestrian/Bicycle Connections		
Bellevue	NM.P&B-4	Lake Washington Blvd - SR 405 to SE 60th - Add ped/bike facilities
Bellevue, Kirkland	NM.P&B-2	BNSF Right of Way - SE 8th to Totem Lake - Add ped/bike facility.
Bellevue, Newcastle, Renton	NM.P&B-6	Lake Washington Blvd/112th - SE 60th to May Creek I/C - Add ped/bike facility
Bothell	NM.P&B-5	North Creek Trail Link - 240th to 232nd - Add ped/bike trail.
Renton	NM. P&B 14	Cedar River Trail S. Extension - I-405 to Burnett Ave - Add ped/bike facilities (ETP NM-17)
Renton	NM. P&B 15	Cedar River Trail/Lake Washington Blvd Connector - Cedar River Trail to Lk Wash Blvd Loop - Add ped/bike facilities (ETP NM-15)
Renton	NM. P&B 16	Cedar-Duwamish Trail Connection - I-405 to Interurban Ave. S. - Add ped/bike facilities
Renton	NM. P&B 17	I-405/SR-167 trail connection - Lind Ave. SE to Talbot Rd S. - Add trail connection
Renton/Tukwila	NM. P&B 18	I-405/1-5 - via or around I-405/I-5 interchange - Add ped/bike facilities
Tukwila	NM. P&B 19	SR-181/W. Valley Hwy - crossing I-405 from Strander Blvd to Fort Dent Way - Add bike lanes

22. I-405 CORRIDOR INTELLIGENT TRANSPORTATION SYSTEM ENHANCEMENTS

Overview

This major element provides ITS enhancements to facilitate more reliable traffic flow.

I-405 Corridor ITS Enhancements		
Jurisdiction	**Project ID**	**Projects**
Various	ITS.1	Add Camera Coverage to decrease TMC blind spots
Various	ITS.2	Complete Ramp Metering
Various	ITS.4	Dual Lane Ramp Metering
Various	ITS.5	Increased Incident Response
Various	ITS.6	Traffic adaptive control on arterials
Various	ITS.7	TIS before all major decision points
Various	ITS.8	WSDOT support of in-vehicle traffic information
Various	ITS.9	Arterial camera coverage

23. I-405 CORRIDOR FREIGHT ENHANCEMENTS

Overview

This major element focuses on improvements specific to freight movements. Note that freight will benefit as well from general purpose traffic expansion described in other elements.

I-405 Corridor Freight Enhancements		
Jurisdiction	**Project ID**	**Projects**
Renton	R.FR-10	Modify SR 167 Interchange for East to South Freight movements
Various	R.FR-11	Improve truck flow with ITS
Various	R.FR-23	Remote area for overnight freight parking and staging for early morning deliveries
Various	R.FR-26	Full depth shoulders for truck usage on key freeways and arterials)
Various	R.FR-27	Traveler Information System (TIS) on SR 167 for I-405 "options"
Various	R.FR-28	TIS on I-5 for SR 18/I-90; and 164th to I-405; and South 200th to I-405
Various	R.FR-29	Centralized fax/radio for real time congestion reporting for dispatchers and truck drivers. Leverage WSDOT video linkages (e.g., a "T-911" number).
Various	R.FR-30	Hours of operation and service periods optimized—"JIT" redefined for applicable service sectors (e.g. restaurants)
Various	R.FR-32	Light cargo delivery using Sound Transit service

APPENDIX B

Alternatives Project Matrix

APPENDIX B

I-405 Corridor Program EIS Alternatives Project Matrix

Element #	Jurisdiction		ACTIONS	Alternatives				
				5	1	2	3	4
				No Action	HCT/TDM	Mixed Mode with HCT/Transit Emphasis	Mixed Mode	General Capacity
10.	**Basic I-405 Improvement Projects**							
	Renton	R.BI-1 & R.FR-10	SR 167 Interchange - Direct Connection with auxiliary lane SB SR 169 to SR 167		✓	✓	✓	✓
	Kirkland	R.BI-2	Continue NB climbing Lane from NE 70th to NE 85th and continue as auxiliary Lane to NE 116th		✓	✓		✓
	Kirkland	R.BI-3	SB auxiliary Lane NE 124th to NE 85th		✓	✓		✓
	Bellevue	R.BI-4	I-90 / Coal Creek Interchange		✓	✓	✓	✓
	Both,King Co,Kirk	R.BI-5	SB SR 522 to 124th continue climbing lane as an auxiliary lane		✓	✓		✓
	Bothell	R.BI-6	NB auxiliary lane SR 522 to SR 527		✓	✓		✓
	Renton	R.BI-7	Kennydale Hill climbing lane - SR 900 to 44th - NB 900 to 30th, SB 44th - 30th		✓	✓		✓
	Bellevue	R.BI-8	I-90 to Bellevue SB HOV direct connection to I-90 west		✓	✓		✓
	Bellevue	R.BI-9	NB auxiliary lane I-90 to NE 8th		✓	✓		✓
	Bellevue	R.BI-10	Increase SR 405 to Eastbound SR 520 Ramp capacity		✓	✓		✓
	Renton	R.BI-14	NB Auxilliary Lane I-5 to SR 167		✓	✓		✓
	Various	R.FR.24	Improve interchange geometrics at all major truck routes (WB-20 Design Criteria)		✓	✓	✓	✓
10.	**Committed Freeway Projects**							
	Joint	R-17 & R-17(17)	I-90/SR 900 Interchange and SR 900 improvements/Interchange reconfiguration Outside of Study Area					
	Joint	R-19	I-90/Sunset Way Interchange/Complete interchange and upgrade nonmotorized connections. Outside of Study Area					
	WSDOT	R-55	I-405/SR 167 Interchange/Construct new southbound I-405-to-southbound SR 167 ramp modification.	✓	✓	✓	✓	✓
	SR 405 Through Capacity (TC)							
11.	**Two additional GP lanes in each direction**							
	Tukwila,Renton	R.TC-1	Two additional GP lanes in each direction - SR 5 Tukwila to SR 167				✓	
	Renton	R.TC-2	Two additional GP lanes in each direction - SR 167 to SR 900/North Renton I/C				✓	
	Renton, Nwcas,Bel	R.TC-3	Two additional GP lanes in each direction - SR 900/North Renton I/C to SR 90				✓	
	Bellevue	R.TC-4	Two additional GP lanes in each direction - SR 90 To SR 520				✓	
	Bellevue,Kirkland	R.TC-5	Two additional GP lanes in each direction - SR 520 to NE 70th				✓	
	Kirkland	R.TC-6	Two additional GP lanes in each direction - NE 70th to NE 124th				✓	
	Kirk,K C,Both	R.TC-7	Two additional GP lanes in each direction - NE 124th SR 522				✓	
	Bothell,Sno Co	R.TC-8	Two additional GP lanes in each direction - SR 522 to SR 527				✓	
	Sno Co	R.TC-9	Two additional GP lanes in each direction - SR 527 to SR 5 Swamp Creek				✓	
13.	**Express Lanes- 2 lanes each direction between major interchanges**							
	Tukwila,Renton	R.TC-20 + R.TC-29a	Add Express lanes - SR 5 Tukwila to SR 167					✓
	Renton	R.TC-21	Add Express lanes - SR 167 to SR 900 North Renton					✓
	Ren, Nwcas,Bel	R.TC-22 + R.TC-33	Add Express lanes -SR 900 North Renton I/C to SR 90					✓
	Bellevue	R.TC-23	Add Express lanes - SR 90 to SR 520					✓
	Bellevue,Kirkland	R.TC-24 + R.TC-32	Add Express lanes - SR 520 to NE 70th					✓
	Kirkland	R.TC-25	Add Express lanes - NE 70th to NE 124th					✓
	Kirk,K C,Both	R.TC-26 + R.TC-31	Add Express lanes - NE 124th to SR 522					✓
	Bothell,Sno Co	R.TC-27	Add Express lanes - SR 522 to SR 527					✓
	Sno. Co	R.TC-29 + R.TC-30	Add Express Lanes - SR 527 to SR 5 Swamp Creek					✓
	Renton	R.TC-28	Add Express lanes- on SR 167 north of 180th up to I-405					✓

∗ ***Evaluated within another project***

APPENDIX B

I-405 Corridor Program EIS Alternatives Project Matrix

Element #	Jurisdiction	ACTIONS		Alternatives: 5 No Action	1 HCT/TDM	2 Mixed Mode with HCT/Transit Emphasis	3 Mixed Mode	4 General Capacity
13.	**Express Lanes - Access Locations**							
	Tuk & Renton	R.TC-29a & R.TC-20	Southern end to Express lanes - Between SR 181 and SR 167					✓ ∗
	Snohomish Co	R.TC-30 & R.TC-29	Northern end to Express lanes - Between SR 527 and I-5					✓ ∗
	King Co,Kirkland	R.TC-31 & R.TC-26	Slip Ramp- South of NE 160th St					✓ ∗
	Kirkland	R.TC-32 & R-TC-24	Slip Ramp- South of NE 70th St					✓ ∗
	Bellevue, Newcastle	R.TC-33 & R.TC-22	Slip Ramp- South of Coal Creek Pkwy					✓ ∗
	Renton	R.TC-34	Interchange access location- SR 167					✓
14.	**Widen SR 167 by 1 lane each direction to study Area boundary**							
	Renton, Kent	R.CF-8	SR 167 I-405 to Study Area Boundary			✓	✓	✓
14A.	**SR 167 / I-405 Interchange Improvements**							
	Renton	R.FR-10 & R.BI-1	SR 167/I-405 Interchange Add Directional Ramps for major movements			✓ ∗	✓ ∗	✓ ∗
16.	**Connecting Freeway Capacity (Matched to fit I-405 Improvements)**							
	Tuikwila	R.CF-1	SR 518 I-405 to SR 99/Airport Access			✓	✓	✓
	Bellevue	R.CF-3	I-90 South Bellevue to Eastgate				✓	✓
	Bellevue	R.CF-4	SR 520 Bellevue Way to 148th					✓
	Bothell, Woodin	R.CF-5	SR 522 Bothell to NE 195th			✓	✓	✓
	Sno Co, Lynnwood	R.CF-6	SR 525 I-405 to SR 99			✓	✓	✓
	Tukwila	R.CF-9	I-5 at Tukwila			✓	✓	✓
	Lynnwood	R.CF-10	I-5 at Swamp Creek - 44th to 155th			✓	✓	✓
10A.	**One additional GP or Auxiliary lane in each direction**							
	Tukwila,Renton	R.TC-9	One additional GP lanes in each direction - SR 5 Tukwila to SR 167			✓		✓
	Renton	R.TC-10	One additional GP lanes in each direction - SR 167 to SR 900/North Renton I/C			✓		✓
	Ren, Nwcas,Bel	R.TC-11	One additional GP lanes in each direction - SR 900/North Renton I/C to SR 90			✓		✓
	Bellevue	R.TC-12	One additional GP lanes in each direction - SR 90 To SR 520			✓		✓
	Bellevue,Kirkland	R.TC-13	One additional GP lanes in each direction - SR 520 to NE 70th (Varify need for additional through capacity on this section)			✓		✓
	Kirkland	R.TC-14	One additional GP lanes in each direction - NE 70th to NE 124th			✓		✓
	Kirk,K C,Both	R.TC-15	One additional GP lanes in each direction - NE 124th SR 522			✓		✓
	Bothell,Sno Co	R.TC-16	One additional GP lanes in each direction - SR 522 to SR 527			✓		✓
	Sno. Co	R.TC-17	One additional GP lanes in each direction - SR 527 to SR 5 Swamp Creek			✓		✓
18.	**Arterial Capacity (AC) Actions**							
	King Co	R.AC-2 & R-39	138th Ave - Petrovitsky Rd to SR 169- Add 1 lane. See R-39					
	King Co, Renton	R.AC-3	138th Ave SE - Construct roadway link to 4/5 lanes- SR 169 to NE 4th St				✓	✓
	Ren, Nwcas,Bel	R.AC-4	140th Ave/Coal Creek Pkwy- Widen to 6 lanes to I-405					
	Redmond	R.AC-15 & R-111	Willows Rd- NE 90th St to NE 124th St- Add 1 lane each direction					✓ ∗
	King Co,Woodin	R.AC-16	Willows Rd- NE 124th St to NE 145th St- construct new facility -4/5 lanes				✓	✓
	Woodinville	R.AC-17 & R.PA-28	SR 202- NE 145th St to SR 522- widen to 5 lanes				✓ ∗	✓ ∗
	Red,K C,Woodin	R.AC-18 & R.PA-28	SR 202 - NE 90th to NE 145th					✓ ∗
	Ren, K C, Issaqu	R.AC-19 & R.IC-5	SR 900 - SR 405 to Edmonds. Additional capacity is not needed					
	Both,S C,Mill Cr	R.AC-20	SR 527/Bothell Everett Hwy - SR 522 to SR 524 - Widen by 1 lane each direction					✓
	Both,Woodin	R.AC-30 & R.PA-25	SR 202 connection across SR 522 to 120th				✓ ∗	✓ ∗
	Bothell	R.AC-34	120th Ave NE - SR 522 to NE 195th (4 lns existing additioal not needed)					

∗ ***Evaluated within another project***

APPENDIX B

I-405 Corridor Program EIS Alternatives Project Matrix

Element #	Jurisdiction	ACTIONS		5 No Action	1 HCT/TDM	2 Mixed Mode with HCT/Transit Emphasis	3 Mixed Mode	4 General Capacity
				Alternatives				
	Tukwila	R.AC-35	SR 181- S 180th to S 200th					✓
	Tukwila	R.AC-36& R.IC-3	SR 181- 144th to Strander Blvd.					✓∗
	Tukwila	R.AC-37	Southcenter Pky - Tukwila Pky to Strander Blvd					✓
19.	**Arterial Interchange Improvements (Matched to fit I-405 Improvements)**							
	Tukwila	R.IC-3 & R.AC-36	SR 181 West Valley Highway/ Interurban See R.AC-36			✓	✓	✓
	Renton	R.IC-4 & R.HOV-43	SR 169 Maple Valley Hwy SR 900 to NE 5th See R.HOV-43			✓∗	✓∗	✓
	Renton	R.IC-5 & R.AC-19	SR 900/ Park - Lake Washington Blvd to Edmonds. Additional capacity is not needed.					
	Bellevue	R.IC-6	Coal Creek Pkwy I-405 to Factoria Blvd.	✓	✓	✓	✓	✓
	Kirkland, Redmond	R.IC-8	NE 85th St-Kirkland Way to 124th			✓	✓	✓
	Kirkland	R.IC-9	NE 116th- 114th Ave NE to 124th Ave NE			✓	✓	✓
	Kirkland	R.IC-10	NE 124th- 113th Ave NE to 124th Ave NE			✓	✓	✓
	Bothell	R.IC-11 & R.HOV-41	SR 527-228th to SR 524			✓	✓	✓
	Renton	R.IC-12 & R.HOV-33	Port Quendall overpass at SE 44th. See R.HOV-33					
	Kirk,King Co	R.IC-14	New half diamond interchange to/from north at NE 132nd St				✓	✓
	Bothell	R.IC-21	New SR 405 Interchange at 240th Street SE(Bothell)				✓	✓
	Bothell	R.IC-24 & R-40	NE 160th Street-112th Ave to Juanita/Woodinville Wy See R-40			✓∗	✓∗	✓∗
	Bothell	R.!C-25	NE 195th Street-Ross Rd to North Creek Pkwy (additional capacity not needed)					
	Kirkland	R.IC-26 & R.PA-13	NE 132nd - 113th to 124th Ave NE				✓∗	✓∗
12.	**Collector Distributors (CD) Matched to fit I-405 Improvements**							
	Renton	R.CD-1	SR-167, SR-169, Sunset and SR 900/North Renton;					
	Bellevue	R.CD-2	Coal Creek, SR 90, SE 8th, NE 4th, NE 8th and SR 520;					
	Kirkland	R.CD-3	NE 70th and NE 85th;					
	Kirkland	R.CD-4	NE 116th and NE 132nd;					
	Bothell, King Co	R.CD-5	NE 160th, SR-522 and SR 527					
	HOV (HOV)							
7.	**Committed HOV Projects**							
	Bellevue	HOV-01	I-405 at NE 4th/6th/8th (Bellevue) / Construct new HOV direct access at NE 6th, Improve arterial capacity at NE 4th/8th interchanges	✓	✓	✓	✓	✓
	Bellevue	HOV-02	I-90 (Eastgate) / New I-90 HOV direct access connection to P&R	✓	✓	✓	✓	✓
	WSDOT	HOV-14	I-405 (I-5 Swamp Creek to SR 527)/Construct NB and SB HOV lanes total 6 lanes	✓	✓	✓	✓	✓
	KCDOT	HOV-15	E Lk Samm Pkwy (Iss-Fall City Rd to I-90 on ramp)/Widen to 4/5 lanes + HOV lanes. Outside of Study Area					
	ST	HOV-101	I-405 @ Lind/HOV direct access improvements.				✓	
	ST	HOV-102, R.HOV-58 & R.PA-1	Woodinville Arterial Enhancements/HOV arterial enhancements	✓	✓	✓	✓	✓
	Renton	R.HOV-32	Between Sunset and SR-900 /Park Ave interchange in Renton	✓	✓	✓	✓	✓
	Renton	R.HOV-33 & R.IC-12	NE 44th I/C - HOV Direct Access and Arterial Improvements(Assumes Port Quendall)	✓	✓	✓	✓	✓
	Kirkland	R.HOV-61	NE 85th				✓	
	Bothell	R.HOV-62	SR 522 Campus Access	✓	✓	✓	✓	✓
	Bothell	R.HOV-63	SR 527	✓	✓	✓	✓	✓
	Tukwila	R.HOV-64	Southcenter (In-Line Station). In line station at this location has been dropped.					
	ST	R.HOV-66	I-405 at NE 128th St/HOV Direct Access Improvements	✓	✓	✓	✓	✓

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APPENDIX B

I-405 Corridor Program EIS Alternatives Project Matrix

Element #	Jurisdiction	ACTIONS		Alternatives 5 No Action	1 HCT/TDM	2 Mixed Mode with HCT/Transit Emphasis	3 Mixed Mode	4 General Capacity
7.	**HOV Interchange Ramps (Direct Access)**							
	Tukwila	R.HOV-25	SR 5 I/C @ Tukwila Fwy to Fwy HOV ramps,			✓	✓	✓
	Renton	R.HOV-26	SR 167 I/C Fwy to Fwy HOV ramps,			✓	✓	✓
	Bellevue	R.HOV-27	SR 90 I/C Fwy to Fwy HOV ramps,			✓	✓	✓
	Bellevue	R.HOV-28	SR 520 Fwy to Fwy HOV ramps,			✓	✓	✓
	Bothell	R.HOV-29	SR 522 Fwy to Fwy HOV Ramps			✓	✓	✓
	Sno. Co.	R.HOV-30	SR 5 I/C @ Swamp Creek Fwy HOV ramps.			✓	✓	✓
	Newcastle	R.HOV-65	112th St SE (In-Line Station)			✓		
6.	**Arterial HOV**							
	Bellevue	R.HOV-36	Coal Creek Pkwy from I-405 to Forest Drive		✓	✓	✓	
	Bellevue	R.HOV-37	NE 8th Street from I-405 to 120th Ave NE		✓	✓	✓	
	Kirk, Redmond	R.HOV-38	NE 85th St from Kirkland Way to 148th Ave NE Vicinity		✓	✓	✓	
	Kirkland	R.HOV-39	NE 116th from 115th Ave NE to 124th Ave NE		✓	✓	✓	
	Kirkland	R.HOV-40	NE 124th from 113th Ave NE to 132 Ave NE		✓	✓	✓	
	Bothell	R.HOV-41 & R.IC-11	SR 527 From SE 228th St to SR 524		✓	✓ ∗	✓ ∗	
	Renton	R.HOV-43 & R.IC-4	SR 169 from SR 405 to Riverview Park Vicinity - HOV/Transit Preferential treatment.		✓	✓	✓	
	Renton	R.HOV-44	SW 27th St Corridor in Renton from Oaksdale Ave to SR 167		✓	✓	✓	
	Redmond	R.HOV-47	Avondale Rd from Novelty Hill Rd to Avondale Way/ Construct SB HOV lane		✓	✓	✓	
	Renton, King Co	R.HOV-48	SW 43 St from SR 167 to 140 Ave SE		✓	✓	✓	
	Renton	R.HOV-49	Logan Ave N/N 6 St from S 3 St to Park Dr, Transit Signal Priority		✓	✓	✓	
	Renton	R.HOV-51	Park Dr/Sunset Blvd from Garden Ave to Duvall Ave NE, Que Bypass'		✓	✓	✓	
	Kenmore	R.HOV-53 & R.PA-11	68 Ave NE (Simonds Rd to SR 522) - Construct NB HOV lane		✓	✓	✓	
	Redmond	R.HOV-55	Willows Rd (Redmond Wy to NE 124 St)		✓	✓	✓	
	Kirkland, Bellevue	R.HOV-56	Lake Washington Blvd (SR 520 to Yarrow Bay) - HOV lanes		✓	✓	✓	
	Kirkland	R.HOV-57	NE 68 St/NE 72 Pl (I-405 Vicinity) Que Bypass'		✓	✓	✓	
	Bothell, Woodin	R.HOV-58, HOV-102 & R.PA-1	SR 522 (I-405 to SR 527 - Bothell) WB HOV Que Bypass - See HOV-102					
	Renton, King Co	R.HOV-59	Benson Rd - I-405 to SE Carr Rd - No Project					
	Bellevue	R.HOV-60	Bellevue Way - I-90 to South Bellevue Park and Ride Vicinity		✓	✓	✓	
23.	**Freight (F)**							
	Renton	R.FR-10 & R.BI-1	Modify SR 167 Interchange for East to South Freight movements		✓ ∗	✓ ∗	✓ ∗	
	Various	R.FR-11	Improve truck flow with ITS		✓	✓	✓	
	Various	R.FR-23	Remote area for overnight freight parking and staging for early morning deliveries		✓	✓	✓	
	Various	R.FR-26	Full depth shoulders for truck usage on key freeways and arterials)		✓	✓	✓	
	Various	R.FR-27	Traveler Information System (TIS) on SR 167 for I-405 "options"		✓	✓	✓	
	Various	R.FR-28	TIS on I-5 for SR 18/I-90; and 164th to I-405; and South 200th to I-405		✓	✓	✓	
	Various	R.FR-29	Centralized fax/radio for real time congestion reporting for dispatchers and truck drivers. Leverage WSDOT video linkages (e.g., a "T-911" number).		✓	✓	✓	
	Various	R.FR-30	Hours of operation and service periods optimized—"JIT" redefined for applicable service sectors (e.g. restaurants)		✓	✓	✓	
	Various	R.FR-32	Light cargo delivery using Sound Transit service		✓	✓	✓	
22.	**Intelligent Transportation Systems (ITS)**							
	Various	ITS-1	Add Camera Coverage to decrease TMC blind spots		✓	✓	✓	✓
	Various	ITS-2	Complete Ramp Metering		✓	✓	✓	✓
	Various	ITS-4	Dual Lane Ramp Metering		✓	✓	✓	✓

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	Various	ITS-5	Increased Incident Response		✓	✓	✓	✓
	Various	ITS-6	Traffic adaptive control on arterials		✓	✓	✓	✓
	Various	ITS-7	TIS before all major decision points		✓	✓	✓	✓
	Various	ITS-8	WSDOT support of in-vehicle traffic information		✓	✓	✓	✓
	Various	ITS-9	Arterial camera coverage		✓	✓	✓	✓
4.	**High Capacity Transit (Physically Separated, Fixed Guideway HCT)**							
	Tuk. & Renton	T.HCT-1	HCT- SeaTac to Renton CBD		✓	✓		
	Renton	T.HCT-2	HCT-Renton CBD to NE 44th (Port Quendall)		✓	✓		
	Ren< New & Bel	T.HCT-3	HCT- NE 44th (Port Quendall) to Factoria		✓	✓		
	Bell & Issa	T.HCT-4	HCT - Factoria To Issaquah		✓	✓		
	Bellevue	T.HCT-5	HCT Factoria to Downtown Bellevue		✓	✓		
	Bell & Red	T.HCT-6	HCT - Bellevue to Redmond		✓	✓		
	Bell & Kirk	T.HCT-7	HCT- Bellevue to Totem Lake		✓	✓		
	Kirk & King Co	T.HCT-8	HCT - Totem Lake to Bothell		✓	✓		
	Various	T.HCT-9	HCT - Bothell to Lynnwood		✓	✓		
4.	**High Capacity Transit (Bus rapid transit [BRT] operating improved access HOV lanes on the existing freeway system)**							
	Tuk. & Renton	T.HCT-1	HCT- SeaTac to Renton CBD				✓	
	Renton	T.HCT-2	HCT-Renton CBD to NE 44th (Port Quendall)				✓	
	Ren< New & Bel	T.HCT-3	HCT- NE 44th (Port Quendall) to Factoria				✓	
	Bell & Issa	T.HCT-4	HCT - Factoria To Issaquah				✓	
	Bellevue	T.HCT-5	HCT Factoria to Downtown Bellevue				✓	
	Bell & Red	T.HCT-6	HCT - Bellevue to Redmond				✓	
	Bell & Kirk	T.HCT-7	HCT- Bellevue to Totem Lake				✓	
	Kirk & King Co	T.HCT-8	HCT - Totem Lake to Bothell				✓	
	Various	T.HCT-9	HCT - Bothell to Lynnwood				✓	
4.	**High Capacity Transit Stations**							
	Sea-Tac	HCT.TS-1	Sea-Tac (Outside of Study Area)					
	Tukwila	HCT.TS-2	Southcenter		✓	✓	✓	
	Tukwila & Renton	HCT.TS-3	Tukwila (Longacres)		✓	✓		
	Renton	HCT.TS-4	Downtown Renton		✓	✓	✓	
	Renton	HCT.TS-5	North Renton		✓	✓		
	Renton	HCT.TS-6	Port Quendall		✓	✓	✓	
	Bellevue	HCT.TS-7	Factoria		✓	✓	✓	
	Bellevue	HCT.TS-8	Bellevue Transit Center		✓	✓	✓	
	Bellevue	HCT.TS-9	Bellevue Library		✓	✓		
	Bell & Kirk	HCT.TS-10	SR 520/Northup Way		✓	✓	✓	
	Kirkland	HCT.TS-11	Downtown Kirkland (NE 85th Street)		✓	✓	✓	
	Kirkland	HCT.TS-12	Totem Lake		✓	✓	✓	
	Woodinville	HCT.TS-13	NE 145th Street		✓	✓		
	Woodinville	HCT.TS-14	Woodinville		✓	✓		
	Bothell	HCT.TS-15	NE 195th		✓	✓	✓	

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APPENDIX B

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	Bothell	HCT.TS-16	Canyon Park		✓	✓	✓	
	Sno County	HCT.TS-17	164th Street AW (AshWay)		✓	✓		
	Bellevue	HCT.TS-18	Eastgate		✓	✓	✓	
	King County	HCT.TS-19	Lakemont		✓	✓		
	Issaquah	HCT.TS-20	Issaquah 9Outside of Study area)					
	Bellevue	HCT.TS-21	132nd Avenue NE		✓	✓		
	Bellevue	HCT.TS-22	148th Avenue NE		✓	✓		
	Redmond	HCT.TS-23	Overlake (NE 40th Street)		✓	✓	✓	
	Redmond	HCT.TS-24	Redmond Town Center		✓	✓	✓	
	Redmond	HCT.TS-25	Bear Creek		✓	✓		
	Mercer Island	HCT.TS-26	Mercer Island		✓	✓	✓	
New Transit Service (TS)								
	Various	TS-0	Twenty percent more service than in the proposed 6-year plans for sound Transit, METRO and Community Transit	✓	✓	✓	✓	✓
	Various	TS-1	Fifty percent more service assumed in the current 6-year plans for Sound Transit, METRO and Community Transit					✓
3.	**Transit Service (TS)**							
	Various	TS-2	Twice the service in the proposed 6-year plans for Sound Transit, METRO and Community Transit		✓	✓	✓	
8.	**Park and Rides (PR)**							
	Renton	T.PR-3	Renton Highlands	✓	✓	✓	✓	✓
	Tukwila & Ren	T.PR-6	Tukwila Commuter Rail (Longacres)	✓	✓	✓	✓	✓
	K C	T.PR-8	SR 169 and 140th Place SE		✓	✓	✓	
	K C	T.PR-9	Petrovitsky Rd and 157th Ave SE		✓	✓	✓	
	K C	T.PR-10	140th Ave SE and SE 192nd		✓	✓	✓	
	K C	T.PR-11	SR 515 and SE 208th		✓	✓	✓	
	Kent & Renton	T.PR-12	SR 167 and SW 43rd		✓	✓	✓	
	Kent & Renton	T.PR-13	SR 167 and 84th Ave		✓	✓	✓	
	Redmond	T.PR-17	Willows Rd @ NE 100th		✓	✓	✓	
	Redmond	T.PR-18	SR 202 @ NE 100th		✓	✓	✓	
	Bell & Kirk	T.PR-20	South Kirkland	✓	✓	✓	✓	✓
	Redmond	T.PR-21	Overlake	✓	✓	✓	✓	✓
	Bellevue	T.PR-22	South Bellevue	✓	✓	✓	✓	✓
	Bellevue	T.PR-23	Newport (112th Ave. SE)	✓	✓	✓	✓	✓
	KC	T.PR-24	NE 160th/Brickyard Rd	✓	✓	✓	✓	✓
	Bothell	T.PR-25	Canyon Park (SR 405 and SR 527)	✓	✓	✓	✓	✓
	KC	T.PR-26	SR 202 @ NE 145th		✓	✓	✓	
	Tukwila	T.PR-30	Tukwila	✓	✓	✓	✓	✓
	Kirkland	T.PR-31	Houghton	✓	✓	✓	✓	✓
	Kirkland	T.PR-32	Kingsgate	✓	✓	✓	✓	✓
	Medina	T.PR-33	Evergreen Point	✓	✓	✓	✓	✓
	Bellevue	T.PR-34	Wilburton	✓	✓	✓	✓	✓
	King County	T.PR-35	Lakemont	✓	✓	✓	✓	✓
	Redmond	T.PR-36	Rendmond	✓	✓	✓	✓	✓
	Redmond	T.PR-37	Bear Creek	✓	✓	✓	✓	✓
	Bothell	T.PR-38	Bothell	✓	✓	✓	✓	✓

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APPENDIX B

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	Kenmore	T.PR-39	Northshore	✓	✓	✓	✓	✓
	Kenmore	T.PR-40	Kenmore	✓	✓	✓	✓	✓
	Woodinville	T.PR-41	Woodinville	✓	✓	✓	✓	✓
	Mercer Island	T.PR-42	Mercer Island	✓	✓	✓	✓	✓
	Bellevue	T.PR-43	Eastgate	✓	✓	✓	✓	✓
9.	**Transit Centers (TC)**							
	Renton	T.TC-6	Downtown Renton	✓	✓	✓	✓	✓
	Bellevue	T.TC-8	Downtown Bellevue	✓	✓	✓	✓	✓
	Redmond	T.TC-9	Overlake	✓	✓	✓	✓	✓
	Kirkland	T.TC-12	Downtown Kirkland	✓	✓	✓	✓	✓
	Kirkland	T.TC-14	Totem Lake	✓	✓	✓	✓	✓
1.	**TDM (TDM)**							
	Various	TDM-1	TDM Package		✓	✓	✓	✓
		TDM-2	Expanded TDM Package- Regional Congestion Pricing		✓			
	Pedestrian and Bicycle Facilities (P&B)							
21.	**I-405 Crossings**							
	Bellevue	NM. CR-1	Lk Washington Blvd/112th Ave. SE - crossing I-405 from 106th Ave. SE to 112th Place SE - Add sidewalks		✓	✓	✓	✓
	Bothell	NM. CR-2	Fitzgerald Rd/27th Ave. - crossing I-405 from 228th St. SE to 240th St. SE - Add ped/bike facility		✓	✓	✓	✓
	King County	NM. CR-3	SR-524 (Filbert Road) - crossing I-405 from North Rd to Locust Way - Add sidewalk/paved shoulder		✓	✓	✓	✓
	Sno. County	NM. CR-4	Damson Road - crossing I-405 from 192nd St SW to Logan Rd - Add sidewalk/paved shoulder		✓	✓	✓	✓
	Renton	NM. CR-5	NE Park Drive - crossing I-405 from SR-900/Sunset Blvd to Lake Wash Blvd - Add sidewalk/paved shoulder		✓	✓	✓	✓
	Renton	NM. CR-6	Jackson SW/Longacres Dr SW - crossing I-405 from S. Longacres Way to Monster Rd SW - Add sidewalk/paved shoulder		✓	✓	✓	✓
	Bothell	NM. CR-7	Connection between Sammamish River Trail and North Creek Trail - between SR-522 and NE 195th St. - Add ped/bike overcrossing of I-405		✓	✓	✓	✓
	Bothell	NM. CR-8	SR-527 - crossing I-405 from 220th St SE to 228th St SE - ped/bike facility		✓	✓	✓	✓
21.	**Pedestrian/Bicycle Connections**							
	Bellevue,Kirkland	NM.P&B-2	BNSF Right of Way - SE 8th to Totem Lake - Add ped/bike facility.		✓	✓	✓	
	Bellevue	NM.P&B-4	Lk Washington Blvd - SR 405 to SE 60th - Add ped/bike facilities		✓	✓	✓	
	Bothell	NM.P&B-5	North Creek Trail Link - 240th to 232nd - Add ped/bike trail.		✓	✓	✓	
	Bel,Nwcas,Ren	NM.P&B-6	Lk Washington Blvd/112th - SE 60th to May Creek I/C - Add ped/bike facility		✓	✓	✓	
	Renton	NM.P&B-14	Cedar River Trail S. Extension - I-405 to Burnett Ave - Add ped/bike facilities		✓	✓	✓	
	Renton	NM.P&B-15	Cedar River Trail/Lake Washington Blvd Connector - Cedar River Trail to Lk Wash Blvd Loop - Add ped/bike facilities		✓	✓	✓	
	Renton	NM.P&B-16	Cedar-Duwamish Trail Connection - I-405 to Interurban Ave. S. - Add ped/bike facilities		✓	✓	✓	
	Renton	NM.P&B-17	I-405/SR-167 trail connection - Lind Ave. SE to Talbot Rd S. - Add trail connection		✓	✓	✓	
	Renton/Tukwila	NM.P&B-18	I-405/1-5 - via or around I-405/I-5 interchange - Add ped/bike facilities		✓	✓	✓	✓
	Tukwila	NM.P&B-19	SR-181/W. Valley Hwy - crossing I-405 from Strander Blvd to Fort Dent Way - Add bike lanes		✓	✓	✓	✓
17.	**Arterial Committed Projects**		(Note: ID numbers are same as ETP ID's					
	Bothell, Snohomish C	R.AC-21	120th NE/39th SE - NE 95th to Maltby Rd - 4/5 lanes including new connection	✓	✓	✓	✓	✓
	Bellevue	R-08	NE 29th Pl (148th Ave NE to NE 24th St)/Construct new 2-lane road	✓	✓	✓	✓	✓

∗ ***Evaluated within another project***

APPENDIX B

I-405 Corridor Program EIS Alternatives Project Matrix

				Alternatives				
	Jurisdiction	ACTIONS		5	1	2	3	4
Element #				No Action	HCT/TDM	Mixed Mode with HCT/Transit Emphasis	Mixed Mode	General Capacity
	Snohomish Co.	R-10	SR 524 (24 St SW to SR 527)--- Widen to 4/5 lanes including sidewalks, bike lanes	✓	✓	✓	✓	✓
	Bothell	R-13	Beardslee Blvd (Main St to I-405)Widen to 3 lanes+CGS (Project does not add capacity)					
	Joint	R-17 & R-17(10)	I-90/SR 900 Interchange and SR 900 improvements--- Interchange reconfiguration. Project is outside of the Study Area					
	Issaquah	R-18	Issaquah bypass (Issaquah-Hobart Rd to I-90)-- Construct new 4/5 lanes with separated ped/bike trail. Project is outside of the Study Area.					
	Kirkland	R-21	NE 120 St (Slater Ave to 124 Ave NE)--- Construct new 3-lane roadway with ped/bike facilities	✓				
	Redmond/ WSDOT	R-25	SR 202 Corridor Improvements(East Lake Sammamish Pkwy to Sahalee Way)--- Widen to 3/5 lanes; intersection improvements with bike/ped facilities	✓	✓	✓	✓	✓
	Redmond	R-26	NE 90 St (Willows Rd to SR 202)--- Construct new 4/5 lanes + bike facilities	✓	✓	✓	✓	✓
	Redmond	R-28	West Lake Sammamish Parkway (Leary Way to Bel-Red Rd)--- Widen to 4/5 lanes + CGS, bike lanes	✓	✓	✓	✓	✓
	Renton	R-36	Oakesdale Ave SW (SW 31st to SW 16th)--- Construct new 5 lane roadway with CGS	✓	✓	✓	✓	✓
	WSDOT	R-38	SR 522 (SR 9 to SR 2)--- Widen to 4 lanes					
	KCDOT	R-39 & R.AC-2	140 Ave SE (SR 169 to SE 208 St)--- Widen to 5 lanes SR 169 to SE 196 St, widen for turn channels on SE 196. Combines 2 King County CIP projects. A major North-South arterial which serves the Soos Creek Plateau and Fairwood.	✓	✓	✓	✓	✓
	KCDOT	R-40 & R.IC-24	Juanita-Woodinville Way (NE 145 St to 112th Ave NE) Widen to 5 lanes + CGS, walkway/pathway	✓	✓	✓	✓	✓
	KCDOT	R-41	East Lake Sammamish Pkwy (Issaquah-Fall City Rd to SE 56 St)--- Widen 4/5 lanes including bike facilities. Construct CGS; interconnect traffic signals. Project is outside of the Study Area.					
	Issaquah	R-42	Sammamish Plateau Access Road (I-90 to Iss.-Pine Lake Rd)-- Prepare EIS, construct new 5-lane arterial w/ CGS, bike lanes. Project is outside of the Study Area.					
	Sammamish	R-44	228 Ave SE (SE 24th to NE 8 St)--- Widen to 4/5 lanes + CGS, bike lanes. Planned in 2 phases. Project is outside of the Study Area.					
	KCDOT	R-45	Issaquah-Fall City Rd (Issaquah-Pine Lake Rd to Klahanie Dr) - Phase II & III--- Widen to 4/5 lanes + CGS, bike lanes. Project is outside of the Study Area.					
	KCDOT	R-47	NE 124 St (Willows Rd to SR 202)--- Widen to 4/5 lanes + CGS, bike facilities; traffic signal.	✓	✓	✓	✓	✓
	KCDOT	R-48	Avondale Rd (Tolt Pipeline to Woodinville-Duvall Rd)--- Widen to 3 lanes + walkway/pathway (Project does not add capacity)					
	Woodinville	R-51	Woodinville-Snohomish Rd/140 Ave NE (NE 175 St to SR 522)--- Widen to 4/5 lanes + CGS, bike lanes	✓	✓	✓	✓	✓
	KCDOT	R-52	Woodinville-Duvall Rd (NE 171st St to Avondale Rd)--- Widen to 5 lanes + shoulders (without widening towards Woodinville the added capacity can't be used)					
	Bellevue	R-101	150th Ave SE---Widen to 7 lanes from SE 36th to SE 38th; add turn lanes	✓	✓	✓	✓	✓
	Redmond	R-111 & R.AC-15	Willows Rd Corridor Improvements-- Channelization of Willows Rd/Redmond Way intersection and widening of Willows Rd from NE 116th to NE 124th	✓	✓	✓	✓	✓
	Snohomish Co.	R-117	39th Ave SE Realignment at SR 524 and York Rd--- Construct 4-way intersection to replace 2 offset intersections	✓	✓	✓	✓	✓
17.	**Planned Arterial Projects**							
	Sound Transit	R.PA-1, HOV-102 & R.HOV-58	SR 522 (Woodinville to Bothell)--- HOV enhancements (ETP 246) See HOV-102					
	Bellevue	R.PA-2	148 Ave SE (SE 24 St to SE 28 St) New SB lane from SE 24 St to the WB I-90 on-ramp (ETP 203)			✓	✓	✓
	Bothell	R.PA-3	SR 522 Multimodal Corridor Project--- Widen SR-522 mostly within existing ROW to provide transit lanes, safety improvements, consolidated driveways & left turn lanes; and sidewalks. (ETP R-107)			✓	✓	✓
	Bothell	R.PA-4	SR 524 (SR 527 to Bothell City Limit)--- Widen to 5 lanes + CGS, bike facilities (class III) (ETP R-11)			✓	✓	✓
	KCDOT	R.PA-5	SE 212 Way/SE 208 St (SR 167 to Benson Rd/SR 515)--- Widen to 6 lanes + bike facilities, Transit/HOV preferential treatment, turn channels. (ETP R-46)			✓	✓	✓
	KCDOT	R.PA-6	Petrovitsky Rd (143 Ave SE to 151 Ave SE) --- Widen to 5 lanes + CGS, bike lanes, traffic signal, interconnect (ETP 265). Project has already been constructed.					
	KCDOT	R.PA-7	Bear Creek Arterial (NE 80 St to Novelty Hill Rd)--- Corridor study and construction of new 3 lane arterial (ETP 141). Project is outside the study area					
	KCDOT	R.PA-8	NE 124/128 St (SR 202 to Avondale Rd)--- Widen to 4/5 lanes including bike & equestrian facilities (ETP 164)			✓	✓	✓
	KCDOT	R.PA-9	SE 208 St (116 Ave SE to 132 Ave SE)--- Widen to 4/5 lanes + CGS, bike lanes, traffic signal (ETP 263). Project has already been constructed.					

∗ ***Evaluated within another project***

I-405 Corridor Program EIS Alternatives Project Matrix

	Jurisdiction	ACTIONS		Alternatives 5	1	2	3	4
Element #				No Action	HCT/TDM	Mixed Mode with HCT/Transit Emphasis	Mixed Mode	General Capacity
	KCDOT	R.PA-10	NE 132 St Extension (132 Ave NE to Willows Rd Ext.)---- Construct new 3 lane arterial with CGS, bike lanes (ETP 61)			✓	✓	✓
	Kenmore/KCDOT	R.PA-11 & R.HOV-53	68 Ave NE (Simonds Rd to SR 522)--- Construct NB HOV lane total of 5/6 lanes (ETP 22)			✓ ∗	✓ ∗	✓
	Kirkland	R.PA-12	124 Ave NE (NE 85 St to Slater Rd NE)--- Widen to 3 lanes (s. of NE 116th St, 5 lanes n. of NE 116th St with ped/bike facilities (ETP R-23)			✓	✓	✓
	Kirkland	R.PA-13 & R.IC-26	NE 132 St (100 Ave NE to 116 Way NE)--- Widen to 3 lanes + CGS, Bike lane (ETP R-124)			✓	✓	✓
	Kirkland	R.PA-14	NE 100 St (117 Ave NE to Slater Ave) --- Construct bike/pedestrian/emergency Vehicle overpass across I-405 (ETP 309)			✓	✓	✓
	Newcastle	R.PA-15	Coal Creek Pkwy (SE 72 St to Renton City Limits)--- Widen to 4/5 lanes + CGS, bike lanes, traffic signals (ETP R-24)			✓	✓	✓
	Redmond	R.PA-16	Redmond 148th Ave NE Corridor - 3 projects--- Turn lane and channelization improvements along corridor – BROTS;			✓	✓	✓
	Redmond	R.PA-17	Bear Creek Pkwy--- Construct new 162nd Ave NE arterial and new 72nd St arterial w/ bike/ped and CSG; widen Bear Creek Pkwy (ETP R-110)			✓	✓	✓
	Redmond	R.PA-18	Union Hill Rd (Avondale Rd to 196 Ave NE)--- Widen to 4/5 lanes with bike facilities (ETP R-27)			✓	✓	✓
	Renton	R.PA-19	Duvall Ave NE (NE 4 St to NE 25 Court -City Limits)--- Widen to 5 lanes + CGS, bikeway (ETP R-31)			✓	✓	✓
	Renton	R.PA-20	Oakesdale Ave SW (Monster Rd to SR 900) Replace Monster Rd Bridge; widen to 4/5 lanes +Bike Lanes + CGS (ETP R-35)			✓	✓	✓
	Renton	R.PA-21	Rainier Ave / Grady Way (intersection)-- Grade separation			✓	✓	✓
	Renton	R.PA-22	SW Grady Way (SR 167 to SR 515)--- Rechannelize and modify signals for a continuous eastbound lane (ETP R-37)			✓	✓	✓
	Renton	R.PA-23	SR 167 at East Valley Road--- New southbound off-ramp and signalization at East Valley Road (ETP 255)			✓	✓	✓
	Renton/ KCDOT	R.PA-24	Soos Creek Regional Links--- Placeholder for Trans-Valley Study (ETP R-115)			✓	✓	✓
	Woodinville	R.PA-25 & R.AC-30	SR 522 Interchange Package(SR 522/SR 202 &SR522/195th St)--- Access improvements and new freeway ramps (ETP R-53) (See R.AC-30)			✓	✓	✓
	Woodinville	R.PA-26	SR202 Corridor Package (SR202/148th Ave & SR202/127th Place)--- Intersection improvements (ETP R-54)			✓	✓	✓
	WSDOT	R.PA-27	SR 520/SR 202 Interchange --- Complete interchange by constructing a new ramp and thru lane on 202 to SR 520 (ETP R-29)			✓	✓	✓
	WSDOT	R.PA-28 & R.AC-17	SR 202 / 140 Place NE (NE 124 St to NE 175 St)--- Widen 4/5 lanes (ETP R-43) (See R.AC-17, 18)			✓	✓	✓
	WSDOT	R.PA-29	SR 202 (Sahalee Way to Bear Creek-Sammamish Arterial)-- Widen to 4/5 lanes (ETP 152). Project is outside the Study Area.					

∗ ***Evaluated within another project***

APPENDIX C

Transportation Demand Management Memorandum

I-405 CORRIDOR PROGRAM

Technical Memorandum on Transportation Demand Management

Core Assumptions for No Action Alternative

Element Objectives: *Ensure that key existing TDM programs are able to meet new demand generated by the above activities*

Establish administrative procedures to ensure establishment and oversight of the I-405 TDM Program

For there to be a very substantial stepping up of TDM activities in a major corridor certain underlying issues must be adequately addressed to ensure the success of the newly expanded program. One of those is that important existing public sector TDM programs must be expanded to help ensure that they can meet new demand. Also, new programmatic administrative mechanisms must be established. One such important factor that must be addressed in an on-going basis is monitoring and evaluation. TDM is a constantly evolving field – for example as shown by the impacts that computers have had on the transportation system in the last few years. It will be important within the I-405 TDM Program to maintain oversight and flexibility so that decisions can be made, if necessary, to reallocate funds from less effective to more effective strategies as more knowledge is gained and/or as times change.

The major Core Assumptions are:

- <u>Existing TDM Programs will continue (public and private) –</u>
  Although Initiative #695 severely cut transportation funding, and has had an impact on TDM programs, the I-405 TDM Program assumes that about the current level of TDM activities will continue in the corridor. This includes:
  The Commute Trip Reduction Program
  The Regional Ridematch System ("Ridematch")
  TMAs in Redmond, Bothell and downtown Bellevue
  The Vanpool programs of King County Metro and Community Transit
  The Commuter Challenge Program's efforts to increase Telecommuting
- <u>Existing public TDM programs (at the least) will be expanded to meet new market demand -</u>-
  The I-405 TDM Program includes a very substantial amount of new marketing and promotion of transportation alternatives.
- <u>Implementation of any new corridor-wide SOV/VMT trip reduction goals will be supported by an interlocal or subregional agreement</u> --
  For some TDM strategies to be broadly embraced corridor-wide they must be

implemented in a manner that doesn't unfairly burden or impact just some of the jurisdictions in the corridor. The best way to accomplish this is a new interlocal agreement along the lines of what was called for by the Trans-Lake Study Team, and which is also being pursued within that project.

- <u>TDM strategies must be flexible, monitored, evaluated and adjusted over time –</u> TDM is a discipline that is always evolving, which is one of its advantages – it can adapt to changing times and needs. Monitoring and evaluation is a key component of the I-405 TDM Program to ensure that the funds are being directed at the most effective strategies throughout the 20 year life of the program.
- <u>Funding will be provided for demonstration projects, as well as limited funding for new TDM strategies that are found to be effective via such demonstration -</u>- Due to what has historically been limited availability of funding for TDM, new and promising ideas often go untried. Funds are included within this program to provide for demonstrations of promising new strategies so that both the corridor planners and the region can continue to gain new knowledge.
- <u>A certain level of centralized oversight and management of the new corridor TDM program would be required on an on-going basis</u> --
  Given the size, breadth, complexity and 20 year duration of the I-405 TDM Program, some on-going centralized management support and oversight would be necessary.

The I-405 TDM Program has been developed as an integrated program of supportive and companion TDM strategies that provides "carrots" to reduce SOV trips and to reshape demand within the I-405 corridor. The "carrots" used to shape the development of the major elements within the I-405 TDM Program for all four action alternatives focused on Single Occupant Vehicle (SOV) trip reduction by offering incentives, increasing access to alternative modes, and providing financing for vanpool, transit media, Commute Trip Reduction (CTR) and parking programs. Pricing is the one "stick" and is only in Action Alternative 1 (HCT/TDM Emphasis). Since TDM can be viewed as "built-in" mitigation, it may be appropriate to implement many of the major TDM elements before roadway construction starts, as mitigation during construction activities, and as continuing mitigation for operational impacts to the transportation system resulting from roadway or development projects.

Transportation Demand Management (TDM) is a term applied to a broad range of strategies that are primarily intended to reduce and reshape use of our transportation system in order to help maximize the system's effectiveness and efficiency. Some TDM strategies have been around for many years and are very simple, such as carpooling, which became so important during World War II. Other TDM strategies have evolved more recently, such as vanpooling – and, even more recently, Telecommuting and Car-Sharing. The success of many TDM strategies often depends both upon the active cooperation of the private sector and upon affecting decision-making by the individuals who use the transportation system.
Both the region's Metropolitan Transportation Plan and the state's Washington Transportation Plan include assumptions that a substantial percent of growth in trips in

the region will be accommodated by TDM. However, funding for TDM has been nowhere near levels that would be necessary for that to be achieved. For TDM to accomplish what the plans expect of it, it is important that significant funding for TDM be included within balanced, multi-modal solution packages developed through planning efforts, such as corridor studies.

For TDM strategies to reach their maximum potential they need to be packaged into a mutually supportive program, such as the I-405 TDM Program described below. For example, it would be pointless to market vanpooling if, at the same time, it was not assured that the operating agencies have vans available for newly formed groups. It would also, for example, be pointless to require employers to subsidize monthly transit passes if there was no bus service to the worksites.

Many TDM strategies can be clearly categorized as either “carrots” (incentives) or “sticks” (disincentives). Examples of “carrots” are vanpool fare subsidies and tax credits. Required parking charges and mandatory commute trip reduction programs are examples of "sticks”. The I-405 TDM Program is built upon the assumption that more “carrots” will be most acceptable and, therefore, most effective at reducing or reshaping use of the transportation system in the corridor.

With TDM being such a broad term, it can be difficult within efforts like corridor studies to decide what to include within the TDM program and what to include elsewhere. Bus service and improvements for pedestrians and bicyclists can be considered TDM because they provide alternatives to driving alone. In the I-405 Corridor Study, however, they have not been included within the TDM Program. It is important to note, however, that the I-405 TDM Program does include <u>all</u> of the marketing and promotion, communications, and educational efforts that will be aimed at encouraging travelers to use all transportation modes other than driving alone. So, while within the transit component of the I-405 Corridor Program a doubling of transit service is called for, all of the marketing efforts that would deliver the new customers to that service are included within the TDM Program described below.

The TDM strategies that are included within the I-405 TDM Program have been packaged into the following major elements:

- Vanpooling
- Public Information, Education and Promotion
- Employer-Based Programs
- Land Use as TDM
- Pricing
- Other Miscellaneous Strategies
- Core Assumptions (support the above)

Below, each of the above major elements is described further.

#1 Vanpooling
Element Objective: *Maximize vanpooling in the corridor by adding 1680 new vanpools over 20 years.*

Vanpooling involves groups of commuters (usually seven to fifteen) who regularly commute together in a van, which in this region is usually provided by a public transit agency. The riders pay monthly fares covering most of the costs and the volunteer driver pays no fare.

Washington state leads the nation is the number of vanpools operating with about 1450 public vanpools in the state, 1250 of which are in the Central Puget Sound Region. A recent study of the vanpool market in the Central Puget Sound Region showed that 2% of commuters now vanpool (1/6th as many as who commute on the bus). The study also showed that 7% of commuters traveling over 20 miles one way to work are vanpooling, and that 55% of vanpools cross county lines. In looking at the current market potential for vanpooling, something that had never been done before, the study found that a very large untapped market for vanpools currently exists. It is estimated that 268 public vanpools currently operate in the corridor, a strong base upon which to build.

The major components of this element are:

- Intensive New Marketing –
  Permits greatly increased vanpool marketing. Most marketing to date has been focused somewhat narrowly on employers affected by the Commute Trip Reduction (CTR) Law (at times even that marketing doesn't occur because of lack of available vans). "Value-added" incentives, such as frequent flyer miles for vanpoolers, would also be included in vanpool marketing.
- Provision of Vans –
  Provides vans to the transit agencies so that they can substantially increase their fleets and, therefore, meet the demand created by the intensified marketing and the subsidy below.
- 50% Fare Subsidy –
  The attractiveness of vanpooling is related to its cost. Prior to the passage of Initiative 695, Community Transit implemented a 40% vanpool fare subsidy, with a resultant quadrupling of the number of vanpools operating. This component provides a 50% subsidy for all vanpools that substantially operate in the I-405 corridor.
- Owner-Operated Vanpooling Promotion–
  Promotes use of personal vans as commuter vanpools. Such vanpools operate at no cost to the public. An excellent guidebook currently exists, but very little promotion of this approach has occurred to date.

#2 Public Information, Education & Promotion

Element Objectives: *Keep the public highly informed about transportation issues, programs and related developments in the corridor*

Increase travelers' awareness of alternative travel options

Public information, education and promotion efforts complement and increase the effectiveness of all other TDM strategies, as well as most other strategies (such as new transit service), by creating a climate that fosters public awareness of the need for, and acceptance of, alternative travel options, along with a clearer understanding of the problems that increased use of alternatives helps to address.

One current problem in the I-405 corridor is the lack of any coordinated effort to keep the public informed in a <u>comprehensive</u> manner about issues and developments related to the <u>total</u> transportation system in the corridor. Most jurisdictions and agencies have their own public information programs, but there's not an over-arching, umbrella-like information program that helps the public understand how all of the pieces and planned actions fit together. Thus the public can think that "no one is in charge", even though there is extensive coordination usually occurring.

Convincing people to change how they make trips, when they make them, or even if they make them, is not an easy task. The need for this change requires constant reinforcement. Travelers also need to be regularly reminded of the transportation alternatives that are available to them.

The major components of this element are:

- <u>On-going Public Information, Education & Promotion Campaign</u> – Provides for a major on-going informational campaign to keep the public informed of transportation issues, projects, activities and options in the corridor. This would function like a "clearing-house" pulling together all information so that a comprehensive picture can be presented.
- <u>Traveler Information Services</u> – Supports and expands existing Traveler Information Systems with a focus on new telecommunications and computer technologies such as dynamic ride-matching or Advanced Traveler Information Systems (ATIS).
- <u>Personalized Trip Planning Assistance</u> – A significant percent of people change their home and/or work locations regularly. This provides new one-on-one assistance to help such commuters (and others) to understand their new travel alternatives.

#3 Employer-Based Strategies

Element Objective: *Reduce drive-alone commuting and Vehicle Miles of Travel (VMT) to worksites in the corridor*

Employers have often played key roles in many TDM programs that have evolved to date. This role has been amplified in the state since the passage of the Commute Trip Reduction (CTR) Law in 1991. The CTR law requires most larger employers to reduce the percent of their employees who drive-alone to work, along with reducing associated VMT. Since 1993, drive-alone commuting to King County worksites affected by the CTR law has been reduced by 4.73%. Additionally, it is estimated that the CTR law has resulted in a 1% reduction in all trips region-wide.

Employer-based strategies are very effective for reducing trips during peak periods. The successful implementation of this strategy is dependent upon other TDM strategies, such as vanpooling, telecommuting and personalized trip planning.

The major components of this element are:

- <u>Increased Work Options</u> –
  Provides promotion and incentives for broader adoption of Telecommuting (Telework), Flextime, compressed and multiple work shifts and Proximate Commuting (working nearer one's home).
- <u>CTR Incentives and Resources</u> –
  Provides new and increased incentives and other resources to help CTR-affected employers attain (and perhaps surpass) their CTR goals.
- <u>New/Expanded Voluntary CTR-Type Program</u> –
  Establishes and helps support a new non-regulatory-based CTR like program aimed at larger employers not affected by the CTR law and at smaller employers. There are approximately 3500 such employers in the Central Puget Sound Region.
- <u>Transportation Management Associations (TMA) Enhancement</u> –
  TMAs are public/private partnerships, usually employer dominated, formed to help address transportation problems in a specific geographic area. This will provide for the development of 2-3 new TMAs in the corridor and for some on-going support of the corridor's existing three. In addition, it is also expected that TMAs would be directly contracted with for specific services, such as personalized trip planning.
- <u>Parking Cashout Incentives and Financing</u> –
  Parking Cashout in a term applied to giving all employees the amount equal to the value of their parking. They, then, can either buy back their parking or keep all or part of the money by, for example, carpooling or walking to work.

#4 Land Use as TDM

Element Objective: *Broader implementation of land development patterns that reduce demand on the transportation system*

How land is used, how that use is regulated, and how such factors as design standards support that use, may be the ultimate TDM strategy. It also may be the TDM strategy that takes the longest amount of time before its effectiveness to positively change or reduce trips can be judged. It is, however, the very core of this region's approach for dealing with the substantial projected growth in population, jobs, trips and Vehicle Miles Traveled (VMT). Such Land Use TDM strategies focus on reducing demand on the transportation system.

The primary focus of the Land Use TDM element is to support reducing or changing trips by encouraging compact, mixed-use and non-motorized, transit-friendly development or redevelopment in target areas within the corridor. The successful implementation of this element will depend on highly collaborative and coordinated processes that could be supported by an interlocal agreement as discussed in the Core Assumptions section that follows.

The land use components of the I-405 TDM Program focus on providing new support and incentives that would help local jurisdictions implement actions that strengthen the link between their land use and transportation plans. Local jurisdictions have indicated that such support/incentives are necessary in order for them to make needed adjustment in regulations and processes. Educational and advocacy help is also needed.

The major components of this element are:

- <u>Encouragement of Transit/Pedestrian-Oriented Development (TOD)</u> –
Provides informational and staff support and incentives to support and supplement current TOD efforts within the corridor.
- <u>Changes to Land Use Codes and Regulations, and Streamlining Permitting Processes and Design Review</u> –
Promotes, advocates for, and provides support to local jurisdictions to make adjustments that will support compact developments or TODs and increased use of alternative modes and/or elimination of trips.
- <u>Developer/Business Incentives</u> –
Provides support to jurisdictions to help them determine if and what types of incentives they may want to use to support the changes they've implemented to encourage TODs or compact, mixed-use, and non-motorized and transit-friendly (re)development in target areas. Some incentive funding and support to developers during the design review and permitting process is also provided.
- <u>Parking Management Programs</u> –
Provides information and staff support to assist jurisdictions to affect the supply, locations and demand of/for parking.

- Local Connectivity Retrofit Projects –
  Staff of local jurisdictions have indicated that they are aware of many small barriers to increased non-motorized connectivity (e.g., fences, small sections of missing sidewalks). This establishes an annual small grants program to allocate funds to jurisdictions in the corridor to remove some of the connectivity barriers.

#5 Pricing

Element Objective: *Reduce trips through fees for parking and/or for traveling on I-405 during peak periods*

Pricing is considered to be a very effective TDM strategy by influencing individual decision-making about travel needs through cost. Within the I-405 TDM Program, parking and congestion pricing is included in only Action Alternative 1 (HCT/TDM Emphasis) and will be based on estimates from the Puget Sound Regional Council (PSRC) Pricing as a TDM strategy has been deferred to the PSRC since pricing may be best implemented at a regional level and PSRC currently has a task force looking at transportation pricing.

#6 Miscellaneous TDM Strategies

Element Objective: *Help ensure the success of the other elements at reducing and/or eliminating trips*

During development of the I-405 TDM Program certain important strategies were identified that didn't logically fit within the above elements, but which were determined to be important in helping to ensure the success of those elements. Those elements are:

- Innovative Fare Media, Demonstrations and Incentives –
  Provides funds and incentives to take much further in the corridor some of the highly innovative approaches to transit and vanpool fare media that have been implemented, or are still in development, by King County Metro. This includes ideas such as community-wide FlexPasses. A FlexPass is a multi-modal transportation pass that everyone gets. Use of it is paid for after the fact based on the amount of usage.
- Non-Commute Trip Research and Demonstrations –
  Little is known about TDM strategies that can be effective at reducing trips that are not related to work. This provides for research and for a limited number of demonstrations of non-work trip focused TDM strategies that appear promising.
- Park & Ride Leased Lots –
  Throughout the corridor numerous small park & ride lots have been established as secondary uses of parking developed primarily for other purposes (e.g., churches and movie theaters). This provides for the expansion of that program to help support additional use of transit and ridesharing modes. New, permanent Park & Ride lots are addressed elsewhere within the I-405 Corridor Program.

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APPENDIX D
Freight Mobility Memorandum

I-405 CORRIDOR PROGRAM

Technical Memorandum on Freight Mobility

OVERVIEW

This freight mobility technical memorandum for the I-405 Corridor Program Phase 4 EIS responds to the outline of effort described in the Scope of Work. It builds upon previous work done for Phase 3 as well as other sources of information. These include data from the Puget Sound Regional Council (PSRC), WSDOT, TRAC / University of Washington, and FASTrucks (FAST Phase 2).

The information contained in this report represents the most current and available data on freight movement in the I-405 corridor. The ongoing FASTrucks study, moving toward completion in early 2001, will provide further up-to-date information on future truck movements.

1. THE DETERIORATING SITUATION FOR FREIGHT MOVEMENT IN THE I-405 CORRIDOR

The efficient movement of freight and goods within the I-405 corridor, indeed throughout the entire Puget Sound region, is reaching a critical point. Economic factors such as global trade, just-in-time inventory, deregulation, the technological explosion and escalating fuel prices are pressuring the freight community to deliver products faster, more reliably, and at a lower cost. At the same time, the decreasing reliability of the regional transportation system creates a serious problem for truckers in accessing markets and delivering products. And both the Eastside and the region's population and employment are expected to continue growing at a healthy rate in the coming decades. These factors are contributing to a growth in truck trips and truck movements at the same time that increasing congestion on the transportation system is making those trips less and less reliable.

The University of Washington's TRAC center has put together some remarkable and revealing information that shows just how serious the congestion and system reliability problem is becoming. Figures 1 and 2 show the hours of congestion found on I-405 for the average weekday in 1999. Figure 1 depicts the heavy commute congestion southbound in the morning and northbound in the evening on the portion of I-405 between I-90 and I-5 in Snohomish County. Note the significant congestion throughout the day northbound through downtown Bellevue. This is a critical problem for trucks moving goods from the Green River Valley and southern areas to points in the northern portion of the metropolitan area. Travel time is slowed and accessibility is hampered. Some trucking firms have established new terminals in northern locations in order to deliver goods on time. This is a significant cost for firms already pressured by rising fuel prices. Ultimately, these costs will be passed on to the consumer. One firm, UPS, has considered unconventional options for dealing with the growing reliability and congestion problem (see Appendix A). Contrary to the news story, UPS has no immediate plans for helicopter services, but it shows that the business community is beginning to think about different or even radical ways to deliver goods on time.

Figure 2 depicts congestion on the section of I-405 between I-90 and I-5 at Tukwila. This also shows the morning and afternoon peaks, but it also shows heavy congestion throughout the day on much of the section. It is especially acute in the areas near SR 169 and SR 167. This is in part due to the weave/merge problem at the SR 167/I-405 interchange. Notice also the heavy congestion between SR 167 and I-5. This congestion on the southern sections of I-405 is creating enormous delay and hurting truckers' accessibility to and from Green River Valley warehouses and freight terminals. Improvements to this section of the corridor, from I-90 to I-5 at Tukwila, are the most critical for truck movement.

This congestion translates to lengthened travel times in the corridor, as Figures 3 and 4 indicate. Not only are travel times increased substantially during peak periods, but they remain higher throughout most of the day. As noted by the 90th percentile GP (general purpose) travel time, system reliability is beginning to be further defined in terms of the predictability of congestion and its recurring characteristics. One-on-one interviews with the trucking community during work on the FASTrucks study indicate truckers' concerns with the congestion problem and the shrinking window of time in which they can operate efficiently (see Appendix A, *Responses from Individual Interviews With Trucking Community*). Truckers also said I-405 was one of the routes that they used most frequently, and the interview responses emphasized the need to increase capacity throughout the transportation system, especially at interchanges.

What does the currently deteriorating situation mean for the future? With a growing economy and increasing population according to regional forecasts for 2020, truck trips will continue to increase; currently, there are estimated to be about 1.2 million truck trips per day in the region (FASTrucks model development, Cambridge Systematics, Inc., based upon information from Quick Response Freight Manual and PSRC model data). Recent data indicate that truck traffic is growing at a faster rate than general-purpose traffic (SR 509/South Access Rd. Freight Mobility Study, Dec. 1998). And as the population base increases and expands to new areas, a commensurate growth in light to medium truck traffic to serve these newly developed areas can be expected. Table 1 shows a forecast of future truck volumes at selected locations along the I-405 corridor. Corridor Program Working Paper 18, Draft Existing Freight Conditions, December 1999, reported a growth rate in truck traffic of nearly 3 % per year from 1994 to 1997 on Eastside roadways, according to WSDOT data (Table 13, WP 18).Assuming this rate of increase per year in traffic (3%), given the region's strong economic growth, average daily volumes will grow from just over 7,000 now at the SR 181 interchange to almost 10,000 in 2010. At the SR 520 interchange, truck volumes are expected to grow from 7300 now to nearly 11,000 in 2010. As the table indicates, truck volumes will almost double along I-405 by 2020. With a bad situation at present, conditions will only worsen without necessary freight mobility improvements.

2. REGIONALLY SIGNIFICANT FREIGHT ROADWAY NETWORK: I-405 FITS IN!

Within the Puget Sound region, the I-405 corridor is an important component of a regionally significant freight roadway system that has been identified by the Puget Sound Regional Council (PSRC). Map 1: *FASTrucks Regional Freight Map* shows these roadways have regional significance for freight movement. This roadway network was developed by the PSRC after several years of coordination with local jurisdictions and WSDOT. It is based on the State's Freight and Goods Transportation System (FGTS) categories T-1 through T-4. These are roadways that carry significant amounts of freight tonnage on an annual basis. Tonnages are shown for category T-1 (more than 10 million Gross Vehicle Weight tons/year), T-2 (4 to 10 million GVW tons/year), and T-3 and T-4 (less than 4 million GVW tons/year). In addition to annual tons moved, other criteria were included in developing the regionally significant freight roadway network, such as connection to urban centers and industrial employment locations, and important freight intermodal facilities: local community impacts; and system continuity. These additional roadways are included in the T-3/T-4 category on the map. In sum, this is the key network of roads for regional freight mobility both now and in the future. Without essential improvements to the I-405 system link, regional freight & goods movement will suffer.

Table 1:
Future Truck Volumes on I-405

Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2020
I-405 / I-5 Interchange Tukwila	6700	6901	7108	7321	7541	7767	8000	8240	8487	8742	9004	9274	9553	9839	13223
SR 181 Interchange	6700	6901	7108	7321	7541	7767	8000	8240	8487	8742	9004	9274	9553	9839	13223
SR 169 Interchange	6700	6901	7108	7321	7541	7767	8000	8240	8487	8742	9004	9274	9553	9839	13223
SR 169 After Ramp	6000	6180	6365	6556	6753	6956	7164	7379	7601	7829	8063	8305	8555	8811	11842
I-90 Start Interchange	6000	6180	6365	6556	6753	6956	7164	7379	7601	7829	8063	8305	8555	8811	11842
I-90 End Interchange	6000	6180	6365	6556	6753	6956	7164	7379	7601	7829	8063	8305	8555	8811	11842
SR 520 Begin Interchange	7300	7519	7745	7977	8216	8463	8717	8978	9247	9525	9811	10105	10408	10720	14407
SR 520 End Interchange	7300	7519	7745	7977	8216	8463	8717	8978	9247	9525	9811	10105	10408	10720	14407
SR 522 Begin Interchange	7300	7519	7745	7977	8216	8463	8717	8978	9247	9525	9811	10105	10408	10720	14407
SR 522 End Interchange	3800	3914	4031	4152	4277	4405	4537	4674	4814	4958	5107	5260	5418	5580	7500
SR 527 Begin Interchange	3800	3914	4031	4152	4277	4405	4537	4674	4814	4958	5107	5260	5418	5580	7500
SR 527 End Interchange	3800	3914	4031	4152	4277	4405	4537	4674	4814	4958	5107	5260	5418	5580	7500

Source: EWITS and WSDOT / TRAC data, averages from classification counts; assumes 3 % growth per year; does not accurately reflect light commercial vehicles

3. DETAILED INFORMATION ON FREIGHT IN THE I-405 CORRIDOR: KNOWING WHERE THE FREIGHT MOVES

The above discussion highlights the I-405 corridor's important role in the regional transportation system. Freight movement is an important component of that multi-modal system and, because of changes in the regional and global economy, it is becoming a larger factor in our need for an improved transportation system.

I-405 Corridor Program Working Paper (WP) 18, *Draft Existing Freight Conditions* (December 1999) described commodity and tonnage flow, location of trucking and distribution facilities, and commodity value within the corridor. This data continues to be valid. I-405 is a significant carrier of freight traffic in East King County. As WP 18 indicates, truck movements into and out of the I-405 corridor make up from 85 to 90 percent of the total truck origins and destinations of East King County. The interviews with truckers (Appendix A) also reveal that I-405 is one of the specific roadways that they use the most. Additional information is presented on Map 2: *Greater Puget Sound Freight and Goods*, which indicates calculated truck trip generation rates for the I-405 Corridor using forecast analysis zone (FAZ) data. Areas with significant freight employment centers are generating the largest amount of trips: Renton, Tukwila and the Green River Valley; and the SR 520 corridor (home to Microsoft and the e-commerce industry). A significant number of trips are also generated in the I-90 and SR 908 corridors. These truck trips are using routes such as SR 181, SR 167, SR 169, and SR 520 as well as I-405. Freight improvements are warranted and recommended for these routes. Map 3 shows locations of warehouse storage facilities in the eastern and southern portions of King County. Besides the I-90 east corridor and the Green River Valley, the I-405 corridor is also a significant location of warehouses, industrial facilities, and, subsequently, freight-trip generation. However, in rapidly developing areas such as urban Bellevue, some warehouse and trucking facilities are being pressured to relocate. Congestion, escalating property values, and incompatible land uses could mean a move to outlying areas such as Pierce County. Many facilities are already locating in the Sumner area. This puts warehousing further and further from major intermodal facilities and transportation networks. Areas well-served by these facilities are being converted to non-freight uses. The FASTrucks study should also yield results on truck trip origins and destinations; so far, results from the FASTrucks modeling effort substantiate the corridor trip information described above.

The *Greater Puget Sound Freight and Goods* map also shows the relationship between generated truck trips and the facilities on the regionally significant freight roadway network (Map 1: *FASTrucks Regional Freight Map*). These are important freight-carrying roadways. I-405 is within the category T-1, with more than 10 million Gross Vehicle Weight tons per year moved. The I-405 corridor also connects to several other roadways in the T-1 category: SR 522, I-90, SR 169, and SR 167. T-2, the next largest carriers of tonnage, include SR 520 and SR 181. As the map indicates, I-405 is an important connecting link to the significant freight-moving routes to Eastern Washington and the Port of Seattle (I-90) and the important north-south corridors to Canada and the Port of Tacoma / Oregon / California (I-5 and SR 167).

In addition to freight tonnage movement, freight traffic volumes are an important indicator of goods movement. Table 1 indicates estimated current and future truck volumes along I-405 at selected locations. As described earlier, volumes are expected to increase and put greater pressure on a corridor that contains minimal facilities for trucks now (only the northbound climbing lane between SR 520 and NE 70th St.) Without improvements, travel time and reliability will worsen. Volumes also are shown on Map 4*: Observed Total Truck Traffic Flows Along the Interstate 405 Corridor.* Major contributing roadways to I-405 volumes are I-5, SR 181, SR 167, SR 169, I-90, SR 520 and SR 522. The set of volume data shows that the routes that have high truck volumes include I-405 as well as the same roads that carry the heaviest amount of freight. As a result, these are the arteries where freight improvements should be concentrated. WSDOT volume data for selected points on the freeway system, including I-405, is also shown on Map 1: *FASTrucks Regional Freight Map*. The FASTrucks (FAST Phase II) study is developing forecasts for future truck movement in the region. Those forecasts are being completed at this time. When data from this effort becomes available, these truck forecasts for I-405 will be updated. Map 5: *Observed Total Truck Traffic Percentage by Category I-405 Corridor* indicates that the truck traffic flow is composed of all truck types from small to large, with the largest trucks concentrated in the I-90 to I-5 at Tukwila portion of the corridor. This underscores the point that this segment of the corridor must be improved to allow for safer and more reliable movement of trucks.

Many of the problems associated with safe truck freight movement relate to poor turning radii and inadequate acceleration / deceleration lanes that exist at some of the interchanges along I-405. Improvement of these deficiencies will allow for easier and safer truck movement and greatly improve travel time, reliability, and accessibility. Locations of proposed improvements are included in the list of recommended improvements in section 5 and will be included in some of the EIS alternatives (see section 4).

Critical locations include the I-405 / SR 167 interchange. This is a major interchange for truck movements to and from the Green River Valley, the largest freight trip generation area in the region. It has been identified as a top priority for improvement by the trucking community during FASTrucks one-on-one interviews. Short weaving areas as well as tight cloverleaf turning movements are creating congestion and safety problems for trucks. Fully directional movements would greatly aid resolution of specific problems at this interchange. In addition, an auxiliary lane between I-5 and SR 167 for northbound traffic, with separate movements for NB and SB 167, is warranted to aid truck movement to the valley as well as general purpose traffic.

SR 181, SR 169, and SR 522 all have tight curves and turning radii as well as steep on-ramps and acceleration lanes at various places. Given these are major truck feeder routes to I-405, improvements are necessary. These are also listed in section 5.

It must be noted that in addition to the roadway system, freight is also carried on an existing railroad line that follows the I-405 corridor. The Burlington Northern-Santa Fe Railroad (BNSF) currently serves a small number of customers on this Renton to Snohomish line, including retail and manufacturing. A dinner train also operates daily on the line during most of the year. It is difficult to predict future freight movements on this line except to point out that BNSF will likely want to maintain control of the corridor. New rail corridors are extremely difficult to site and enough freight customers are likely to remain in the I-405 corridor to warrant short-haul freight service. This is especially true with the large number of warehousing and industrial facilities. It is important to retain this railroad line for freight movement for several reasons. Even though current freight movement on the railroad is a very small percentage of the amount of freight moved by trucks on I-405, there is potential to replace some truck trips in the future by making improvements to the rail line. The I-81 corridor in Virginia contains a parallel rail line which, according to recent studies, could be upgraded to absorb 1000 truck trips per day at one third the cost of adding new highway capacity (*Railway Age*, November 2000). Passenger trains sharing that rail line with freight would also benefit from the upgrade. The BNSF line in the I-405 corridor holds the possibility of a future shared use arrangement with passenger/commuter rail, should that become a feasible transportation alternative. This is the current situation with the mainline BNSF track between Tacoma and Seattle. A major advantage of this option would be to provide transit service to Eastside activity centers while maintaining a freight movement alternative. This could improve the capacity of I-405 by removing some freight or auto trips. If the line is converted to passenger use only, any future capability to provide a freight movement alternative to I-405 is lost. In addition, another advantage of maintaining short-haul freight usage is that one of BNSF's customers on the Renton to Snohomish line is the Boeing Co., which uses rail to move oversize loads that cannot be moved by truck on I-405 due to clearance problems. Finally, any BNSF right-of-way that becomes available in proximity to the I-405 corridor could also be retained for truck mobility purposes, including short-haul freight. The effects of each of the EIS alternatives on rail freight movement are discussed in the next section.

4. SCREENING OF THE EIS ALTERNATIVES: FOCUSING ON THE ONES TO KEEP FREIGHT MOVING

Corridor Criteria, Freight Criteria & Evaluation of Alternatives

The criteria used to evaluate the five EIS alternatives and the recommended improvements are derived from the I-405 Corridor Program Alternatives Evaluation Criteria and, for freight specifically, from the ongoing FASTrucks study. I-405 Corridor Program criteria used here are: *improve mobility* (serve future volumes, improve travel time, provide system connections), *reduce congestion, improve safety,* and *environmental* (improve air quality). Each of the five alternatives were analyzed for these criteria and the results are discussed below and summarized in Table 2.

Freight criteria are to *improve truck mobility* (improve reliability, accessibility, and delay) and *reduce truck impacts on general mobility*, including safety. Reliability refers to the consistent ability for trucks to move freight on the transportation system; congestion, accidents, etc., contribute to decreased reliability. Accessibility refers to the ability for trucks to access warehouses, industrial locations, and markets; again, congestion and deteriorating conditions on freeways and arterials reduce this ability. Delay refers to increase in travel time due to transportation system conditions. Truck impacts on general mobility include queues, accidents, slow movement (on hills for example), etc., that have a negative impact on general traffic movement. These are also summarized in Table 2.

The following discussion references data on truck freight movement that can be applied to each of the alternatives, along with the criteria, for purposes of evaluation. Most of the alternatives, except for the No Action and Alternative 3, include the basic I-405 improvement projects. Some of these projects benefit freight, especially the Kennydale Hill climbing lane, the SB climbing lane between SR 522 and NE 124th, the NB auxiliary lane between I-5 and SR 167, the SB to SB ramp at I-405/SR 167 (a committed freeway project), and improved interchange geometrics at all major truck routes. Alternative 3 includes two new general purpose lanes in each direction, which replace the climbing and auxiliary lanes.

Table 2:
Evaluation of I-405 Alternatives According to Criteria

EIS Alternative	Freight Criteria					Corridor Criteria Applied to Freight			
	Improve Truck Mobility			Reduce Impact on General Mobility, incl. Safety	Comments				
	Reliability	Accessibility	Delay			Improve Mobility	Reduce Congestion	Improve Safety	Improve Environment
HCT/TDM				●	No arterial or GP improvements		●		
Mixed Mode with HCT Emphasis	●		●	●	Additional GP/ Auxiliary lane	●	●	●	
Mixed Mode	●	●	●	●	Two GP lanes	●	●	●	●
General Capacity	●		●	●	Some specific freight projects excluded	●	●	●	●
No Action					Only committed projects included				

Alternative 1—High Capacity Transit/Transportation Demand Management

Although Alternative 1 contains the freight recommendations previously advanced in Phase 3, it does not include fully directional SR 167/I-405 interchange improvements. This interchange is the single most critical bottleneck according to recent surveys of trucking interests done for the FASTrucks effort. It is a significant area of delay, reliability, and accessibility problems for trucks, and an interchange with full directional movement would allow the greatest improvement in freight mobility (this alternative includes the basic improvement projects--geometric modifications only; alternatives two through four have fully directional movements). There are no connecting arterial improvements or other arterial capacity improvements in this alternative. These arterials are important connectors trucks use to access industrial and warehouse locations. In terms of the overall corridor criteria, this alternative can help reduce congestion by improving overall mobility and thereby help freight movement. However, it does not serve future truck volumes and provide good connections as well as some of the other alternatives. Alternative 1 has a negative impact on rail freight movement in the corridor due to the use of portions of the rail line for high capacity transit. A pedestrian/bike facility along the BNSF right-of-way could also limit or preclude future freight movement.

Alternative 2—Mixed Mode with HCT/Transit Emphasis

Freight recommendations included. Contains directional SR 167/I-405 interchange, connecting freeway improvements except for SR 520, and one additional GP or auxiliary lane in each direction—all positive for freight movement. Some arterial capacity improvements are included. These projects address both the freight criteria to improve reliability and delay, and the overall criteria to improve mobility (future volumes, improved travel time, and system connections). Congestion should be reduced. With limited arterial improvements and general capacity increase, accessibility is not addressed as well as alternatives 3 and 4. Like alternative 1, this alternative has negative impacts on the railroad as described above.

Alternative 3— Mixed Mode

This alternative is similar to Alternative 2 except that it contains two additional GP lanes in each direction and more arterial capacity improvements. This would provide significant capacity increases in the system that would be extremely beneficial to truck freight movement. Reliability would improve and delay would be reduced. All specific freight improvements are included. Since high capacity transit is confined to the freeway lanes, freight movement on the rail line is enhanced; however, the pedestrian/bike facility on the right-of-way is still included. Along with alternative four, this alternative is the most positive for freight movement.

Alternative 4—General Capacity

This alternative provides a large capacity increase in the corridor, freeway and arterial, but does not include some of the identified freight improvements—remote parking areas and specific ITS projects for freight, for example. The critical directional ramps at I-405/SR 167 are included. The specific freight projects are essential to improving reliability and accessibility. Like alternative 3, this alternative goes furthest in addressing the freight and corridor criteria. Overall, reliability, delay, and general mobility & safety will be enhanced. Significant improvement in mobility to serve volumes, improve travel time, improve air quality, provide system connections, and reduce congestion will be realized. The express lanes have the capability of reducing travel times for freight substantially. The rail line is preserved for freight movement.

Alternative 5—No Action

From a freight mobility perspective, this alternative does not address any of the criteria to a needed extent. It does include the SB to SB ramp at I-405/SR 167, the Coal Creek interchange, and a few arterial improvements (all committed projects). In short, it provides little relief for the problems for freight movement that have been described in this memorandum.

Table 2 summarizes the evaluation of the five alternatives according to the freight and overall corridor criteria. A mark in a box indicates that the specific alternative addresses the criteria through its recommended set of improvements. As Table 2 and the above discussion point out, Alternatives 3 and 4 rate the highest for freight mobility.

5. RECOMMENDATIONS: KEEPING THE MOVE IN FREIGHT & GOODS MOVEMENT ON I-405

This report presents important information about freight and goods movement in the I-405 Corridor. Current and future traffic conditions and their impact on freight mobility make it critical that improvements to the corridor be made. It is especially serious for the southern section of I-405. The southern section is experiencing tremendous congestion during most hours of the average day, and freight movement is severely restricted by this congestion.

Surveys with the trucking community increasingly demonstrate support of the need for improvements. Particularly needed is improvement to the I-405/SR 167 interchange and the section of I-405 between Southcenter and SR 167. Trucks heading for south SR 167 are restricted by congestion on northbound I-405 and by congestion caused by the short weave section for southbound I-405 traffic. Truck volumes exceed 8,500 per day on both of these movements and congestion is causing delay and accessibility problems. Total average daily traffic exceeds 135,000 between I-5 and SR 167. An auxiliary lane between I-5 at Tukwila and SR 167 for northbound traffic is warranted and included in the basic I-405 improvements.

The following pages provide a listing of all recommended freight improvements for the I-405 Corridor. The first group contains projects previously listed in the Alternative Elements matrix and also in section 23 of Appendix G, Major Elements of Alternatives. The second group contains additional projects that have been identified after further corridor analysis and input from the FASTrucks study. Table 3 indicates how each recommended improvement addresses the freight mobility evaluation criteria (a mark indicates it addresses the criteria in a positive manner). The table also shows which of the alternatives the improvement project is included in.

• FREIGHT MOBILITY RECOMMENDATIONS

• Improvements Previously Identified in Phase 3

Modify SR 167 Interchange for East to South Freight Movements

A significant volume of freight truck traffic is travelling from the ports to the Green River valley. Much of this traffic goes northbound on I-405 from I-5 at Tukwila and continues southbound on SR 167. Congestion occurs regularly at the SR 167 interchange due to freight and general-purpose traffic exiting for SR 167 both north and south. Truck volumes exceed 8,500 per day on three of the four ramps at I-405/SR 167; total daily traffic between Tukwila and SR 167 exceeds 135,000. The southbound movement needs to be separated to allow smoother flow (recommended in conjunction with an auxiliary lane which is part of the basic I-405 improvements)

Improve Truck Flow with ITS

The use of intelligent transportation system (ITS) solutions to improve freight movement is a key part of existing and future strategies. Projects should include:

1. Automatic vehicle identification (AVI transponders)
2. GPS-based vehicle tracking to collect data on freight movement
3. World Wide Web-based real-time traffic information (e.g. WSDOT page)
4. Additional traffic cameras that relay information to message signs
5. Traffic signal integration to improve freight flow
6. Video terminals in trucks that are connected to web & real-time information
7. Clearance (over-height) detection warning systems
8. Electronic information transfer systems
9. Cell phones with internet access for truck driver use to access information
10. Improved incident management systems through electronic notification

The specific ITS projects for freight are included in alternatives 1, 2, and 3. (see also ITS Corridor Plan for I-405)

Remote Area for Overnight Freight Parking and Staging for Early Morning Deliveries

During interviews, truckers have expressed concern that there are not enough places to park trailers within the urban area, including the I-405 corridor. This project would provide truck parking areas near I-405 at each of the major communities in the corridor—Renton, Bellevue, Kirkland, Bothell—as well as the Eastgate area.

Traveler Information System on SR 167 for I-405 Options

This project would provide a variable message sign on NB SR 167 with sufficient advance notice for truckers to make informed decisions regarding use of I-405 or another route such as I-5. (Traveler information system is also included in the I-405 ITS Corridor Plan).

Traveler Information System on I-5 for SR 18/I-90, 164th to I-405, and South 200th to I-405

Message sign installation on I-5 to provide information to truckers. Locations are near SR 18 interchange (this is route option to I-405); near 164th SW on SB I-5; and near South 200th on NB I-5.

Centralized Fax/Radio for Real-Time Congestion Reporting for Dispatchers and Truck Drivers, Leverage WSDOT Video Linkages

Another telecommunication device in addition to ITS is existing fax and radio channels. These can be used to communicate real-time traffic information to drivers. Video terminals can also be linked to WSDOT real-time network.

Hours of Operation and Service Periods Optimized; Just-in-Time Redefined for Applicable Service Sectors (e.g., restaurants)

In effect, a flex-time situation for trucks and freight delivery. Explore possibilities of prioritizing certain routes and delivery schedules. This strategy can help to improve travel time for freight by using time periods of reduced freeway congestion.

Light Cargo Delivery using Sound Transit Service

The startup of regional bus service by Sound Transit may allow for transportation of small packaged freight as an alternative to trucks. It is still premature to estimate the amount of freight that could be handled by this option, but it holds the possibility of removing some truck trips from I-405 and connecting arterials.

• ADDITIONAL FREIGHT IMPROVEMENTS

The following improvements have been identified since Phase 3 of the I-405 Corridor Program. They are the result of further corridor analysis and work being done on the FASTrucks study.

Construct SB Climbing Lane between SR 522 and NE 160th Street

This project enables slow moving vehicles such as trucks to merge gradually into main traffic lanes. This project is included in the basic I-405 improvements (alternatives 1, 2, and 4).

Modify/Improve SR 522 Interchange for East to South and North to East Movements

Existing ramps are very tight curves for trucks to negotiate. Need to improve geometrics for faster flow and safety. There is a basic improvement project in alternatives 1 through 4 to improve interchange geometrics at all major truck routes.

Replace Pedestrian Bridge near NE 70th Street Interchange

The current structure has significant clearance problems for some trucks moving oversize freight. A new structure with adequate clearance is needed. Not specifically called out in the pedestrian projects, but should be addressed in any pedestrian or capacity improvements to corridor.

Modify/Improve SR 520 interchange for West to South and North to East Movements

Improve geometrics and provide additional capacity. Should be in all alternatives except no action under the interchange geometrics-truck routes project.

Improve Coal Creek Parkway Interchange

Need longer deceleration lane for NB I-405 off-ramp; additional capacity, additional lane on NB onramp for slow moving vehicles such as trucks to allow additional time to accelerate and merge. Coal Creek interchange improvement project in all alternatives.

Modify SR 167 Interchange for all Movements

The interchange has significant weave and geometric problems for truck movement. The NB SR 167 to NB I-405 ramp is signed for rollover caution, but trucks continue to have problems there. Congestion is causing serious delay for trucks. This project has been identified more often than any other during interviews with trucking firms. SB to SB ramp project is included in basic improvements; fully directional interchange improvement in alternatives 2, 3, and 4.

Improve NB Ramp to EB SR 169, Improve WB 169 to NB On-Ramp. NB Auxiliary Lane from SR 900 to 30th Street

Geometric problems for trucks. Auxiliary lane will help trucks merge to main traffic lanes. Included in basic I-405 improvements.

SR 181 Interchange Improvements

Improve NB onramp and SB off-ramps. Tight geometrics for trucks. Included in basic I-405 improvements

Additional Variable Message Signs

Need signs on SR 181 approaching from south, on SR 169 approaching from southeast, and on SR 520 and SR 522 approaching from both directions. These will alert truck drivers to conditions on I-405 and enable them to make informed route choices. Message signs on I-405 are included in the ITS portion of alternatives 1 through 4. Signs on arterials connecting to I-405 are not specifically described in the alternatives but are warranted.

Continue to Keep Additional North-South Freight Movement Corridors in Consideration

Previous efforts have studied the possibility of new corridors. Continued congestion and reliability problems in the I-5 and I-405 corridors indicate new north-south corridors should be kept in consideration.

Table 3:
Evaluation of I-405 Freight Improvements

Proposed Corridor Freight Improvements	Freight Criteria: Improve Truck Mobility			Freight Criteria: Reduce Impact on General Mobility, incl. Safety	Included in Alternative				
	Reliability	Accessibility	Delay		1	2	3	4	5 (No Action)
SR 167 interchange E/S movement	●	●	●	●	●	●	a	●	
Improve flow with ITS	●		●	●	●	●	●	d	
Remote parking areas for trucks		●		●	●	●	●		
Traveler Info Systems	●	●	●	●	●	●	●	●	
Centralized fax/radio real-time info	●	●	●	●	●	●	●		
Optimize hours of operation/service	●	●	●	●	●	●	●		
Light cargo on Sound Transit	●	●			●	●	●		
SB climbing lane SR 522 to 160th	●		●	●	●	●	a	●	
Modify SR 522 interchange	●		●	●	●	●	●	●	
Replace pedestrian bridge at NE 70th		●		●					
Modify SR 520 interchange	●		●	●	●	●	●	●	
Improve Coal Creek Pkwy I/C	●		●	●	●	●	●	●	●
Modify all SR 167 movements	●	●	●	●	b	●	●	●	
Improve SR 169 interchange	●		●	●	●	●	●	●	
Improve SR 181 interchange	●	●	●	●	●	●	●	●	
Additional variable message signs	●	●	●	●	c				
Continue consideration of N-S freight	●	●	●	●					

a Auxiliary/climbing lanes replaced by additional general purpose lane.
b Alternative 1 contains project to improve geometrics. Alternatives 2, 3, & 4 contain project to provide full directional movements.
c No specific reference to VMS on connecting state routes such as SR-169 & SR-181.
d Alternative 4 has ITS projects, but not some of specific freight ITS projects.

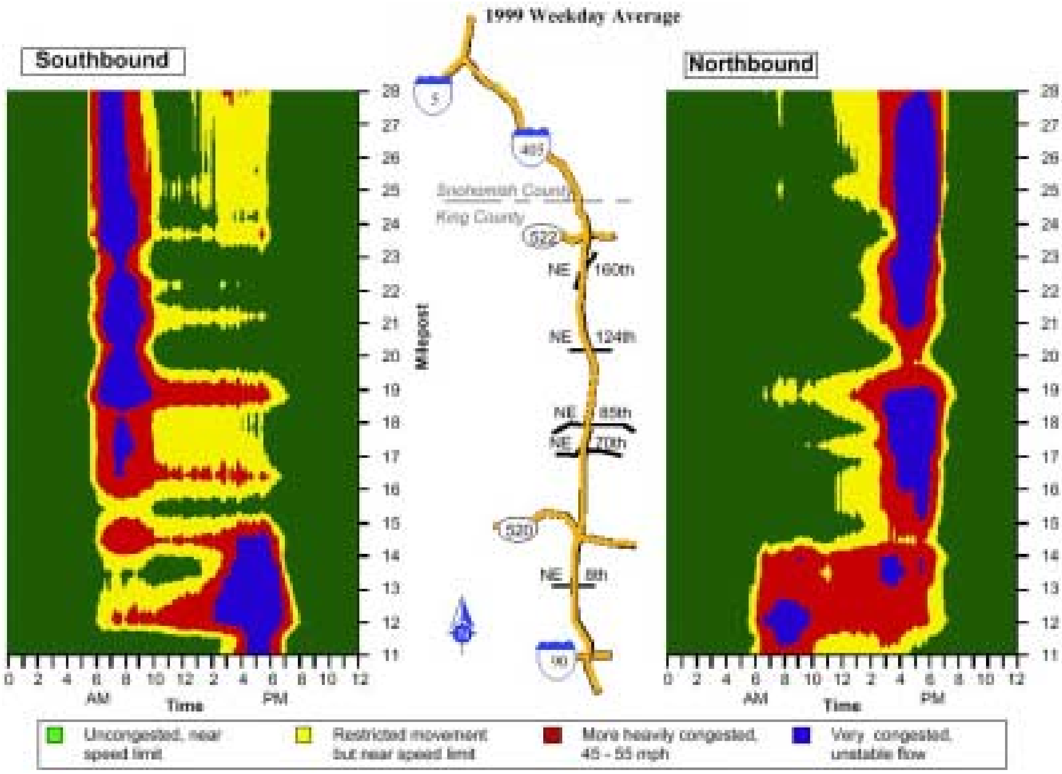


Figure 1. Interstate 405 North Traffic Profile: General Purpose Lanes, 1999 Weekday Average

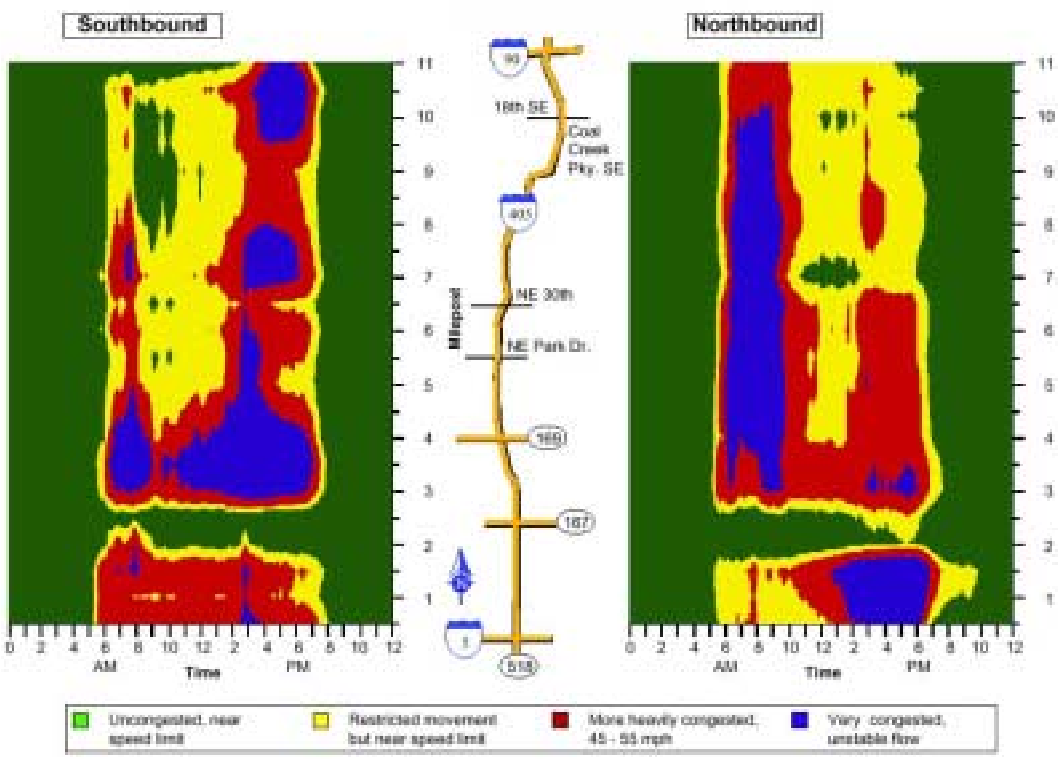


Figure 2. Interstate 405 South Traffic Profile: General Purpose Lanes, 1999 Weekday Average

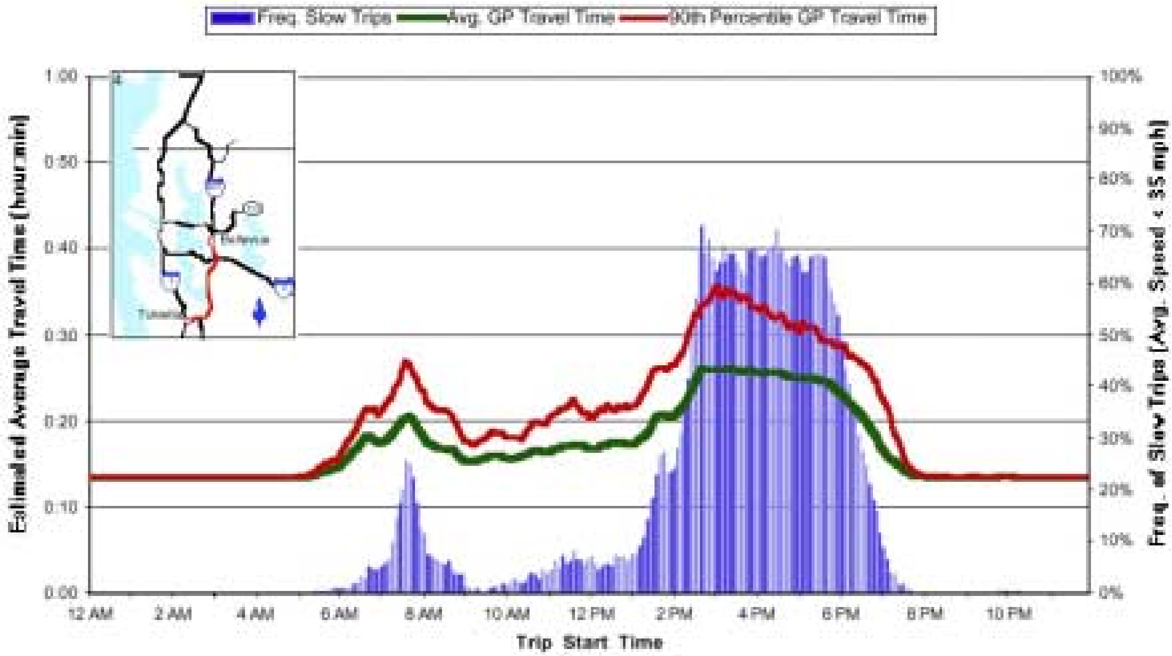


Figure 3. Estimated Average Weekday Travel Time (1999): Tukwila to Bellevue CBD, General Purpose Lanes (13.5 mi)

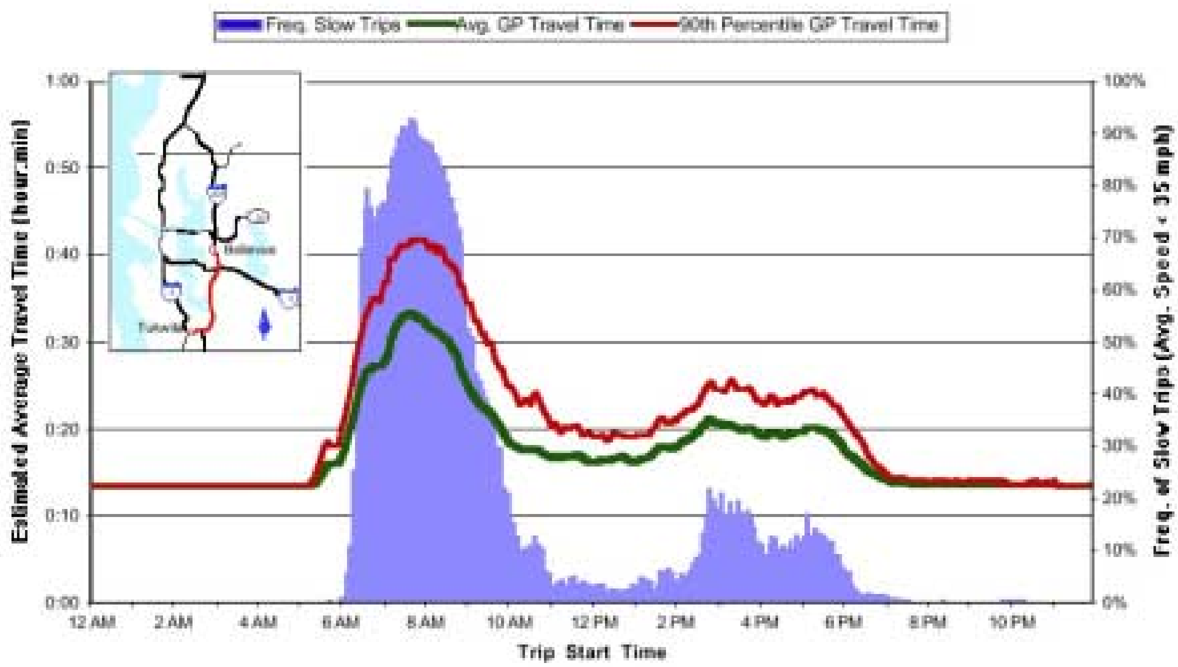
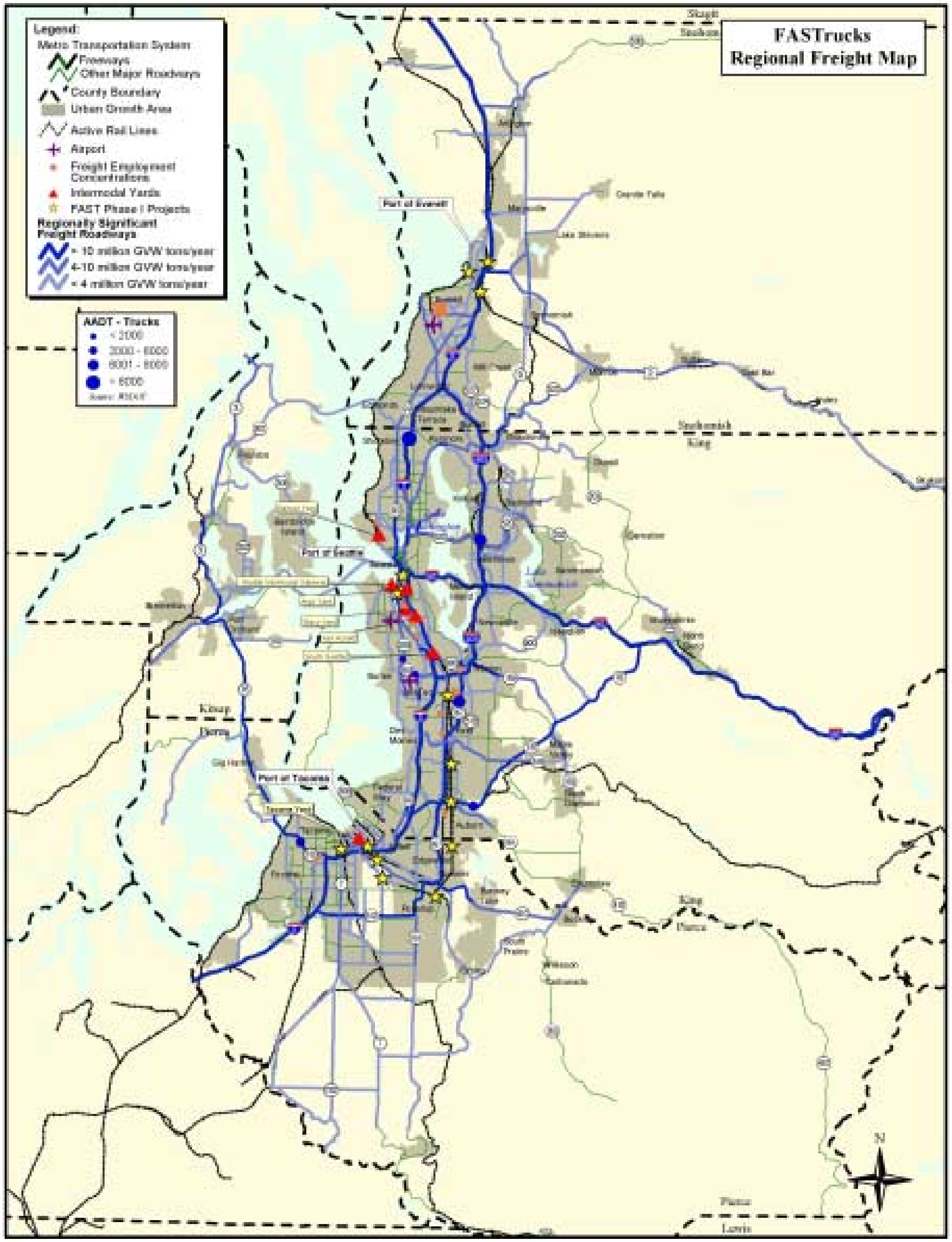
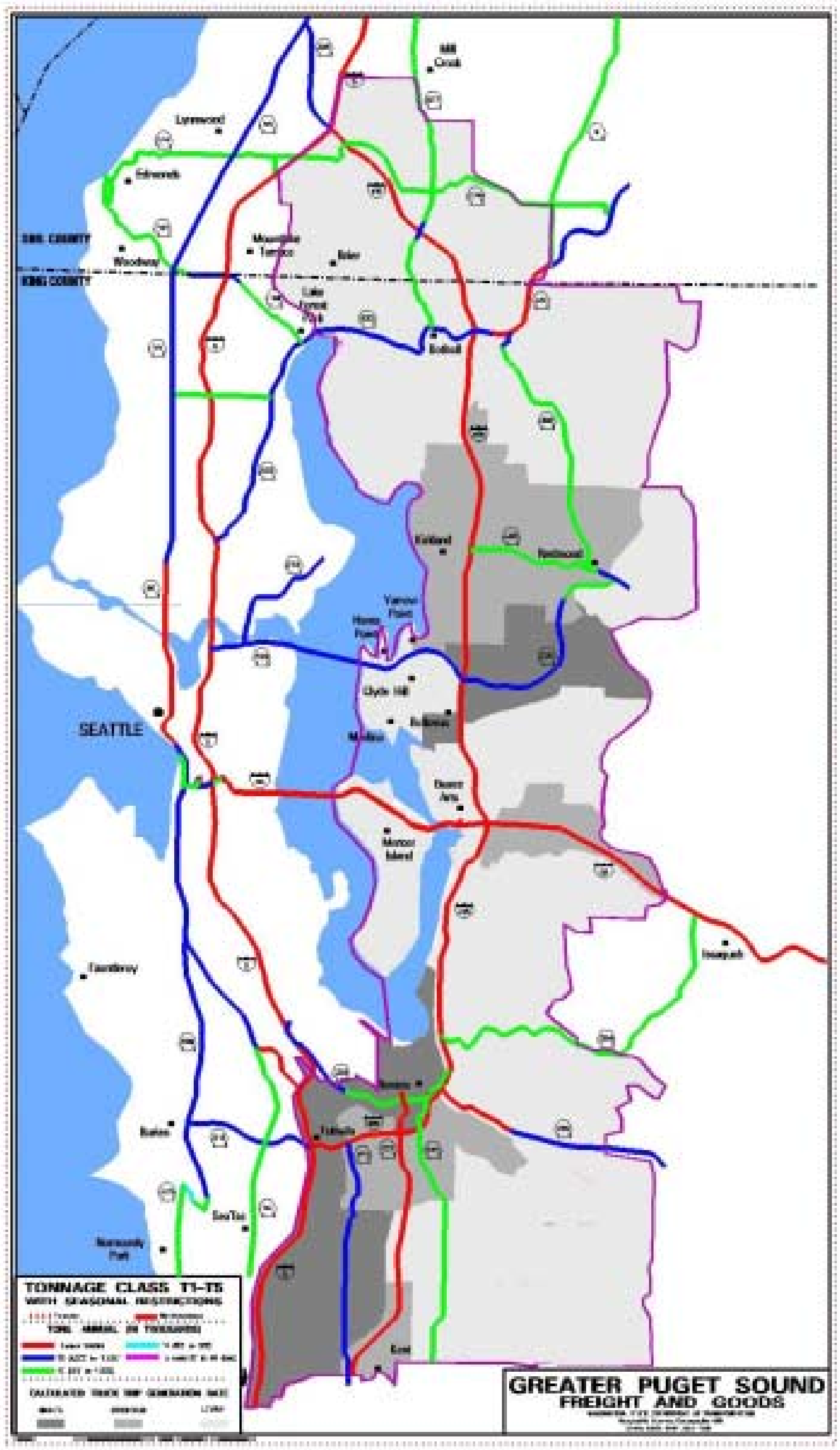


Figure 4. Estimated Average Weekday Travel Time (1999): Bellevue CBD to Tukwila, General Purpose Lanes (13.5 mi)


FASTrucks
Regional Freight Map
Legend:
Metro Transportation System
Freeways
Other Major Roadways
County Boundary
Urban Growth Area
Active Rail Lines
Airport
Freight Employment Concentrations
Intermodal Yards
FAST Phase I Projects
Regionally Significant Freight Roadways
> 10 million GVW tons/year
4-10 million GVW tons/year
< 4 million GVW tons/year
AADT - Trucks
Port of Everett
Port of Seattle
Port of Tacoma
Snohomish
King
Pierce
Lewis
Kitsap
N

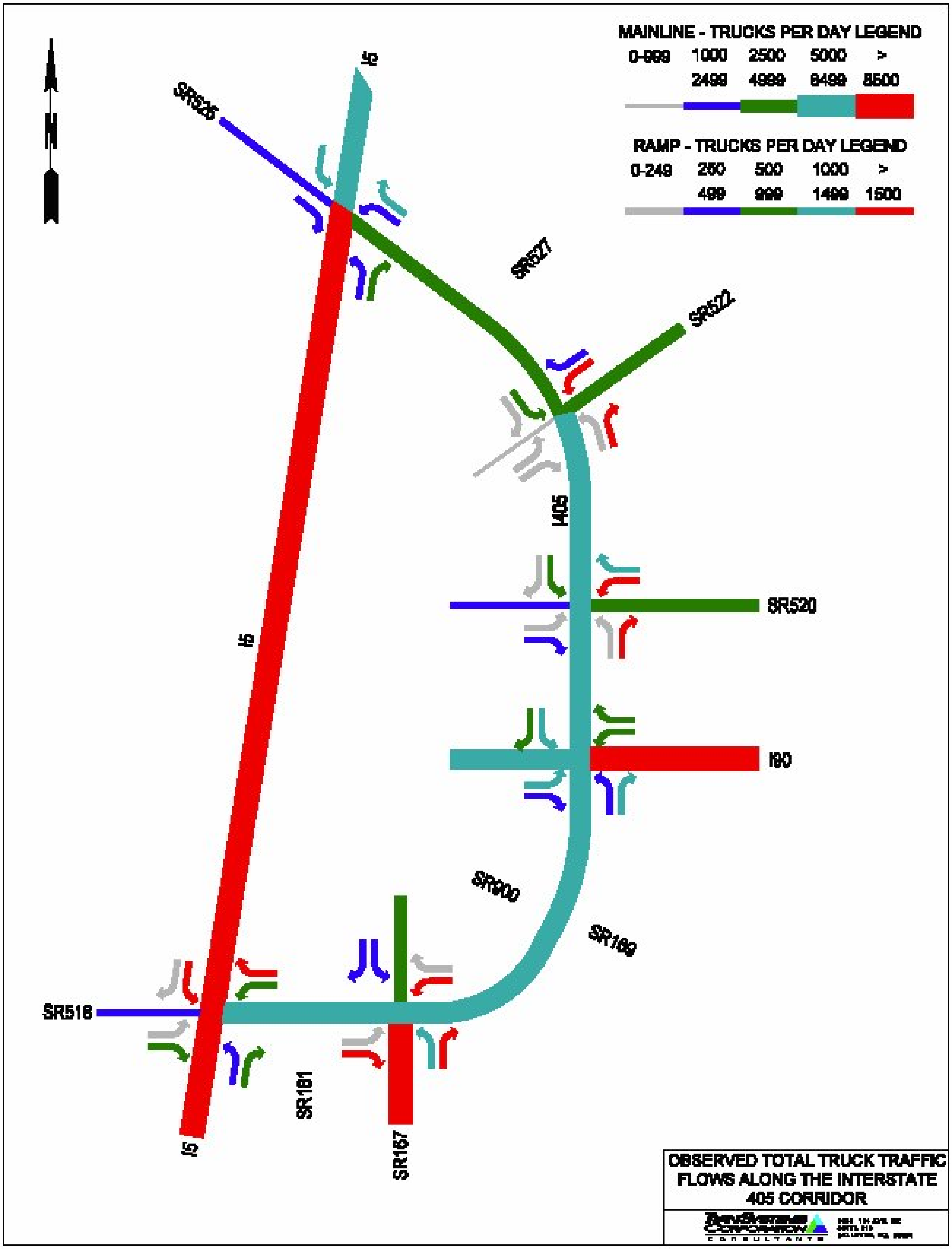
Map 1


SEATTLE
TONNAGE CLASS T1–T5
WITH SEASONAL RESTRICTIONS
GREATER PUGET SOUND
FREIGHT AND GOODS

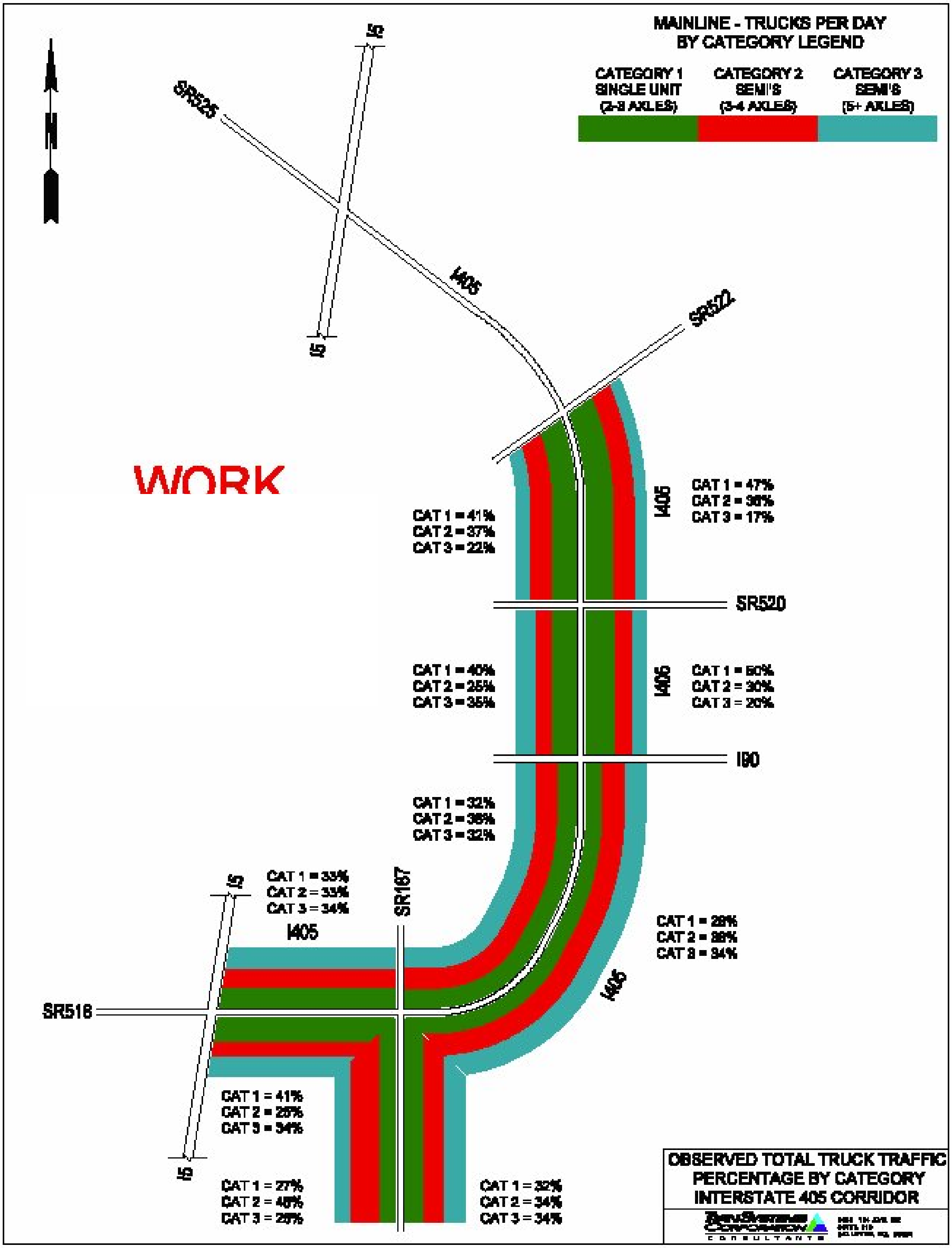
Map 2


Freight
Legend:
Metro Transportation System
Interstate Highways
Other Major Roadways
County
City Limits
Railroad
CONEKC Primary Study Area
I-405 Corridor Program Primary Study Area
Port
Storage Facility, <100,000 SF
Storage Facility, >100,000 SF
Trucking Facility
Mill Creek
Lynnwood
Mountlake Terrace
Bothell
Kenmore
Woodinville
Monroe
Snohomish
King
Duvall
Kirkland
Lake Washington
Redmond
Carnation
Bellevue
Seattle
Sammamish
Lake Sammamish
Mercer Island
Newcastle
Snoqualmie
North Bend
Issaquah
Renton
SeaTac
Des Moines
Kent
Maple Valley
Chester Morse Lake
Federal Way
Black Diamond
Howard Hanson Reservoir
Auburn
Milton
Lake Tapps
Edgewood
Sumner
Enumclaw
Puyallup
Bonney Lake
Buckley
Pierce
South Prairie
1inch = 5.5 miles
Source: King County GIS 1999

Map 3


MAINLINE - TRUCKS PER DAY LEGEND
0-999 1000 2500 5000 >
2499 4999 8499 8500
RAMP - TRUCKS PER DAY LEGEND
0-249 250 500 1000 >
499 999 1499 1500
I5
SR525
SR527
SR522
I405
SR520
I90
SR900
SR169
SR516
SR181
SR167
I5
I5
OBSERVED TOTAL TRUCK TRAFFIC FLOWS ALONG THE INTERSTATE 405 CORRIDOR

Map 4


MAINLINE - TRUCKS PER DAY
BY CATEGORY LEGEND
CATEGORY 1
SINGLE UNIT
(2-3 AXLES)
CATEGORY 2
SEMI'S
(3-4 AXLES)
CATEGORY 3
SEMI'S
(5+ AXLES)
I5
SR525
I405
I5
SR522
WORK
CAT 1 = 41%
CAT 2 = 37%
CAT 3 = 22%
I405
CAT 1 = 47%
CAT 2 = 36%
CAT 3 = 17%
SR520
CAT 1 = 40%
CAT 2 = 25%
CAT 3 = 35%
I405
CAT 1 = 50%
CAT 2 = 30%
CAT 3 = 20%
I90
CAT 1 = 32%
CAT 2 = 36%
CAT 3 = 32%
I5
CAT 1 = 33%
CAT 2 = 33%
CAT 3 = 34%
SR167
I405
CAT 1 = 28%
CAT 2 = 38%
CAT 3 = 34%
SR516
I405
CAT 1 = 41%
CAT 2 = 25%
CAT 3 = 34%
I5
CAT 1 = 27%
CAT 2 = 48%
CAT 3 = 25%
CAT 1 = 32%
CAT 2 = 34%
CAT 3 = 34%
OBSERVED TOTAL TRUCK TRAFFIC
PERCENTAGE BY CATEGORY
INTERSTATE 405 CORRIDOR

Map 5

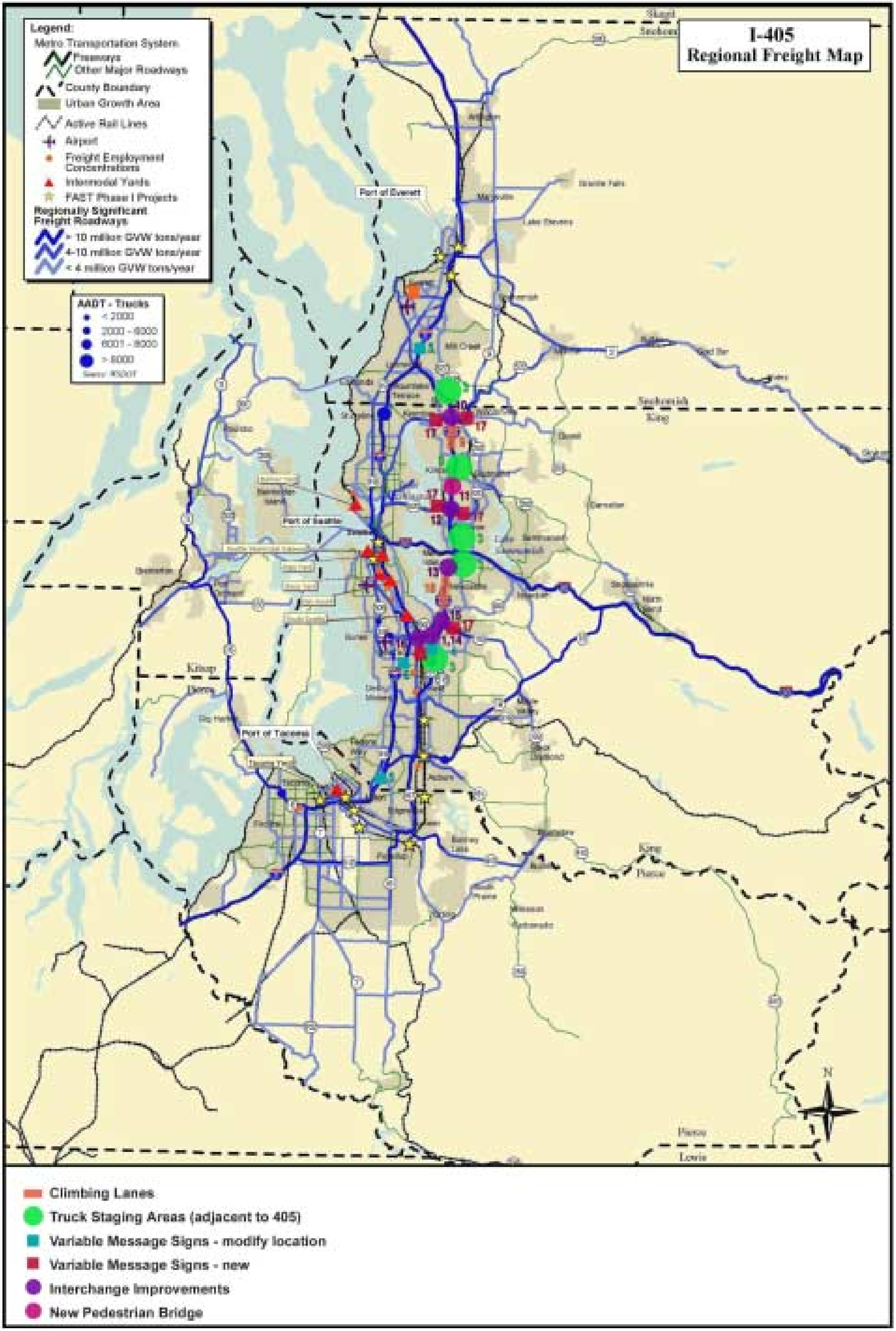
Table 4: I-405 Corridor Program Freight Recommendations (DRAFT)

Ref.	Improvement	Cost	Comments	Agency	Schedule
1	Modify SR 167 Interchange for East to South Freight Movements	$8,000,000	ramp modification NB 405 to SB 167. Significant truck volumes moving from ports to Green River valley. (Alt.3 - 2 GP lanes replaces climbing and auxiliary lanes, including NB from I-5 at Tukwila to SR 167)	WSDOT	2006-2010
2	Improve Truck Flow with ITS		unless otherwise noted, the costs shown below are for "demonstration"-type projects (limited number of trucks or specific locations, hardware/software)		
	AVI	$50,000	transponders that transmit vehicle id to readers	WSDOT, WTA*	2006-2010
	GPS	$500,000	devices in trucks for tracking, data collection	WSDOT, WTA	2006-2010
	Web information	$1,000,000	e.g. WSDOT traffic website	WSDOT, WTA	2006-2010
	Cameras	$500,000	approximately a dozen additional traffic cameras	WSDOT	2006-2010
	Traffic Signal Integration	$3,000,000	candidate connecting corridor would be SR 181, a major route to Green River Valley	Locals	2006-2010
	Video terminals	$50,000	screens in trucks to provide real-time information	WSDOT, WTA	2006-2010
	Clearance Warning	$300,000	would provide clearance detection technology at as many as six locations along I-405 corridor	WSDOT	2006-2010
	Electronic data transfer	$2,000,000	like AVI but two-way data communication	WSDOT, WTA	2006-2010
	Cell phones	$100,000	in trucks, with ability to access Web information	WSDOT, WTA	2006-2010
	Incident Mgmt	$200,000	linked to VMS and response units	WSDOT	2006-2010
3	Remote Area for Overnight Freight Parking and Staging for Early Morning Deliveries	$16,200,000	five sites--Bellevue, Kirkland, Renton, Bothell, Eastgate, 2 acres each in size; $11 M for site acquisition, $5.2 M for construction (adjacent to P&R rides?)	WSDOT, Local Juris., Metro, WTA	2006-2010
4	Traveler Information System on SR 167 for I-405 Options	$50,000	existing sign could be moved, or new sign installed; current sign locations do not allow sufficient time for trucks to make route decisions	WSDOT	2006-2010
5	Traveler Information System on I-5 for SR 18/I-90, 164th to I-405, and South 200th to I-405	$150,000	existing sign could be moved, or new sign installed; current sign locations do not allow sufficient time for trucks to make route decisions	WSDOT	2006-2010
6	Centralized Fax/Radio for Real-Time Congestion Reporting for Dispatchers and Truck Drivers	$50,000	use of current technologies to transmit traffic information	WSDOT, WTA	2006-2010
7	Hours of Operation and Service Periods Optimized; Just-in-Time Redefined	N/A	use of off-peak periods for freight delivery	WTA, Ports, Freight Roundtable	2006-2010
8	Light Cargo Delivery Using Sound Transit	N/A	other nations such as Sweden are using public transportation systems to deliver goods; concept should be studied for Puget Sound region.	Sound Transit, WTA	2006-2010

Ref.	Improvement	Cost	Comments	Agency	Schedule
9	Construct SB Climbing Lane between SR 522 and NE 160th Street	$16,000,000	(in Alt. 3, 2 GP lanes replace climbing lanes)	WSDOT	2011-2015
10	Modify/Improve SR 522 Interchange for East to South and North to East Movements	$8,000,000		WSDOT	2006-2010
11	Replace Pedestrian Bridge near NE 70th Street Interchange	$4,000,000		WSDOT, City of Kirkland	2011-2015
12	Modify/Improve SR 520 interchange for West to South and North to East Movements	$8,000,000		WSDOT	2006-2010
13	Improve Coal Creek Parkway Interchange	$20,000,000		WSDOT	2006-2010
14	Modify SR 167 Interchange for all Movements	$50,000,000	fully directional interchange (SB to SB directional ramp project bids scheduled for June 2001), with some ROW costs	WSDOT, City of Renton	2011-2015
15	Improve NB Ramp to EB SR 169, WB 169 to NB On-Ramp	$8,000,000		WSDOT	2011-2015
16	SR 181 Interchange Improvements	$16,000,000		WSDOT	2011-2015
17	Additional Variable Message Signs	$150,000	new signs on SR 181, SR 169, and SR 522 approaches to I-405. Signs on SR 520 new or moved.	WSDOT	2006-2010
18	Kennydale Hill climbing lanes - NB SR 900 to 30th, SB 44th to 30th	$32,000,000	(in Alt. 3, 2 GP lanes replace climbing lanes)	WSDOT	2011-2015
19	Continue to Keep Additional North-South Freight Movement Corridors in Consideration	N/A	future studies should not preclude looking at new freight corridors	WSDOT, PSRC, Locals	2011-2015
	Total Costs	**$194,300,000**			

Sources for cost data: D. Sipila, DEA; C. Picard, WSDOT. All costs are included in I-405 Preliminary Preferred Alternative (Alt. 3)

*WTA: Washington Trucking Association


I-405
Regional Freight Map
Legend:
Metro Transportation System
Freeways
Other Major Roadways
County Boundary
Urban Growth Area
Active Rail Lines
Airport
Freight Employment Concentrations
Intermodal Yards
FAST Phase I Projects
Regionally Significant Freight Roadways
> 10 million GVW tons/year
4-10 million GVW tons/year
< 4 million GVW tons/year
AADT - Trucks
< 2000
Port of Everett
Port of Seattle
Port of Tacoma
Kitsap
Snohomish
King
Pierce
Lewis
N
Climbing Lanes
Truck Staging Areas (adjacent to 405)
Variable Message Signs - modify location
Variable Message Signs - new
Interchange Improvements
New Pedestrian Bridge

APPENDIX E

ITS Discipline Report

I-405 CORRIDOR PROGRAM

ITS Discipline Report

TABLE OF CONTENTS

LIST OF TABLES

Introduction

REPORT PURPOSE

This document provides the I-405 Corridor Program team with a general framework for future Intelligent Transportation Improvements (ITS) improvements within the corridor. ITS improvements apply advanced technologies to solve transportation problems or create efficiencies. These types of improvements have become commonplace in North America. This document covers both future ITS technologies and the communications necessary for operations.

REPORT CONTENTS

Technology is rapidly developing. Individual technologies that are being deployed today, their specifications, communications, and manufacturers were not available or even non-existent two years ago. The I-405 Corridor Program is a long range planning process for the I-405 Corridor Study Area. Identifying specific technologies or applications would therefore be futile. The items recommended would quickly become outmoded or obsolete.

In addition, the I-405 Corridor Program is conducting a programmatic EIS. Individual locations for each type of improvement are therefore unnecessary. For example, a detailed project-level EIS would examine the footprints of specific variable message sign (VMS) bases and pads in their exact locations. A programmatic EIS will determine the additional surface area of a typical VMS base and pad and include that in an overall figure for additional non-permeable surface.

Given these factors, this document provides functional requirements for future ITS and communications improvements and assigns these functional requirements to subsections of the I-405 corridor. Functional requirements are specific statements about implementation results that support what users want from a system. ITS functional requirements, called user service requirements in the USDOT's National ITS Architecture, direct planners when considering how ITS deployment will address the needs of users--the traveling public and system operators. For the I-405 Corridor Program, these functional requirements describe how of new technologies should operate to meet these needs. When the project-level EIS and designs are conducted, specific technologies will be selected and implemented.

Functional requirements and information provided in this report are based, however, on current technologies or near market-ready technologies that can be easily implemented. Such identifiable technologies as automated highways, which would require further study to determine feasibility and strategies for implementation, are *not* included.

REPORT STRUCTURE

The remainder of this introduction contains an overview of ITS and ITS technologies. The discussion of ITS technologies includes their description, anticipated benefits, and modeling.

Following this introduction are three elements:

- The "ITS Technology Plan" lists the functional requirements relevant to the I-405 corridor.
- "I-405 Communications" describes the short-, medium-, and long-term planning for communications infrastructure in the corridor.
- "National ITS Architecture Infrastructure" relates this plan to the national and regional architectures.

ITS OVERVIEW

ITS technologies have two major focus areas: transportation agency related information and traveler information. The technologies collect, distribute and disseminate information regarding weather, congestion, incidents, construction, tolls, fares, vehicle location, passengers, safety, police activity, available services, alternate routing and facility disposition (e.g., drawbridges up or down, ferry boarding or alighting). The overall goal of these technologies is to provide all relevant information in real-time to transportation managers and users, which will result in better and faster decision making.

For technology, the I-405 Corridor is currently equipped with ITS equipment. Surveillance cameras, in-pavement detectors, variable message signs, ramp meters and other ITS devices have been implemented along I-405 by WSDOT as well as on surface streets by the cities of Renton and Bellevue. In addition, projects included in the no-build alternative of the I-405 Corridor Program will include additional new technologies such as transit signal priority.

For communications many of the ITS devices in the corridor are accessible by multiple agencies due to projects like the North Seattle ATMS, South Seattle ATMS and Smart Trek,. WSDOT, for example, can see and with a few exceptions, control the cameras deployed by cities such as the City of Bellevue. This extends the abilities of transportation managers to react to events both on and off of facilities under their jurisdiction.

The existing ITS devices and communications infrastructure make this corridor relatively well-instrumented and well-connected. Properly augmented and maintained, these implementations should provide adequate coverage to this corridor.

ITS TECHNOLOGIES

As mentioned above there are several technologies in place today that are helping manage transportation. This section provides a short description of existing technologies that serve some more common functional requirements. To simplify the list, they have been divided into six functional bundles: traffic management, public transportation, electronic payment, commercial vehicles, emergency management, and advanced vehicle systems.

Table 1. Functions of ITS Technologies

Bundle	Functions	Technologies	Trends
Traffic Management	• Collect Data • Provide Data • Maintain Traffic Flow • Incident Response • Provide Infrastructure (web sites, phone systems, etc.)	• Loops • Video • Video Detection • Web Sites (public and private) • Television / Radio traffic reports • Ramp Meters • Transit Signal Priority • Traffic Adaptive Control • Variable Message Signs • Highway Advisory Radio • Traffic Hotlines and 511 systems	Public to Private data collection and dissemination. Loop based detectors to video. Stand-alone to smart signal systems Dedicated devices to large integrated systems. ITS as a novelty to standard operations.
Public Transportation Management	• Collect Data • Provide Data • Optimize Performance • Safety	• Transit Signal Priority • Smart Bus • Automated Fare Collection • Video • Smart Cards • Automatic Vehicle Location • Dynamic Routing • Demand Responsive Routing • Paratransit Scheduling • Bus Stop Information • Web Based Information • On-board Information • Automated Stop	Provision of Bus Location information to travelers. On-line schedules. Automated Fare Collection and Regional Fare Integration. Queue bypasses and Transit Signal Priority. Smart Buses and Better Communications. Demand Responsive Routing and Scheduling. Regional Automated Trip Planning

Bundle	Functions	Technologies	Trends
		Annunciation • CCTV Data • Advanced Traveler Information Systems	
Electronic Payment	• Collect Fares • Wireless Funds Transfer • Security • Regional Fare Integration • Automobile Tolls • Tag Recognition / Credentialling.	• Smart Cards • Swipe Cards • Automobile Tags • License Plate Readers • Regional clearing houses. • Video Detection Systems	Swipe cards to smart cards. Regional fare integration. No-wait tolling. Vehicle Identification Remote Sensing
Commercial Vehicle Operations	• Hazardous Materials • Automated Clearance	• Hazmat Tracking • Spill Notification • Vehicle Location • Vehicle Identification and Clearance for HOT Lanes.	Hazmat Tracking through urban areas. Vehicle clearance for weigh stations, toll plazas and other facilities.
Emergency Management	• Incident Notification • Incident Detection • Emergency Vehicle Management • Emergency Management • Evacuation Control • Event Management	• Roadside Call Buttons • Private Cell Phones • Visual Surveillance • Direct Center-to-Center Contact • 9-1-1 provision of police activity to WSDOT TSMC and travelers	Vehicle-based Mayday systems. Automated emergency response Integrated emergency response Direct field crew to hospital communication.
Advanced Vehicle Systems	• Automated Vehicles	• In Development	Under Development

ITS Benefits

In early 2000, the Joint Program Office of USDOT released a report entitled, "Intelligent Transportation Systems Benefits". This report looked at the improvement of transportation conditions in areas where new ITS devices were deployed. In many cases, the deployment and use of ITS devices did apparently result in significant positive impacts on safety, travel time and other critical measures.

The data collected from the test cases often varied widely. Table 2 presents a straight average of results for the various effects measured. It should be noted that often these devices were placed in an area where there was previously no ITS devices or in situations where there may have been other impacts on the transportation network. The placement of similar devices in the I-405 corridor will probably have less impact than the numbers below for the following reasons:

- I-405 already benefits from a fairly robust ITS network,
- The region is forecast to experience high rates of growth in VMT and population, and
- Concurrent construction impacts and post-improvement impacts may extend through the lifecycle of the devices.

Table 2. Benefits of ITS Devices

Effect	Percent
Reduction in stops at red lights due to adaptive control	31.5%
Reduction in delay at red light due to adaptive control	27.6%
Reduction in travel time due to adaptive control	15%
Crash reduction due to enforcement (surveillance of high incident areas—especially red light running)	32.5%
Accident reduction due to ramp metering	33.2%
Increase in speed due to ramp metering	31.2%
Decrease in travel time in Seattle due to implementation of 22 ramp meters	52%
Decrease in accident rate in Seattle due to implementation of 22 ramp meters	39%
Increase in Demand in Seattle during implementation of 22 ramp meters	86%
Reduction in secondary accidents due to incident response system	40%
Hours of delay saved due to incident response systems	723,000
Reduction in incident response time	60%

Perhaps the most important aspect of ITS is the reduction of incidents. A well-designed ITS network not only responds to incidents effectively, but also helps avoid incidents by alerting drivers to congestion, construction or incidents ahead. The combination of variable message sign, CCTV cameras, and other technologies enable transportation managers to alert drivers. This, combined with incident response field crews, on average has yielded a 40% reduction in secondary accidents and a 60% reduction in the time necessary to clear an incident.

Modeling ITS

The I-405 corridor program intends to model ITS components throughout the corridor. In macro- or meso-scale models, this is difficult to achieve as these models generally assume best possible driving conditions. Many of the benefits of ITS are based on reactions to non-standard events, such as incidents, special events or inclement weather.

The modeling of various ITS applications for a corridor is consequently an arduous task. As part of the North Seattle ATMS project, Mitretek modeled the impacts of ITS in the North Seattle area. The project created a very detailed model that took into account the impacts of weather, special events, driver behavior and a wide range of ITS devices and configurations.

The I-405 Corridor Program's modeling effort will not be able to afford a model of this scope and detail. It will be possible to model some impacts of directed ITS solutions in INTEGRATION when the micromodeling is conducted for the preferred alternative.

This modeling will still be high-level, incorporating many assumptions as parameters in the model.

For example, the model will not be able to estimate that a certain number of accidents will be avoided over the course of a year, but it will be able to model the impacts of an incident in a given location both with and without an incident response system.

For specific areas within a corridor, however, there are several tools that can evaluate the effectiveness of ITS deployment. These include ITS Deployment Analysis Software, the sub-regional corridor-modeling tool PRIEVIN, and the project analysis tool TSIS. The modeling of ramp meters and other signal-based systems is also possible.

Given the growth projected for the corridor, ITS improvements in the corridor will need to be fairly uniform in order for the system to be effective. Therefore, we can assume that any system identified in the functional requirements section that follows will be implemented corridor-wide.

I-405 Technology Plan

PLAN STRUCTURE

This ITS Plan describes the functional requirements for all alternatives. It derives these functional requirements from the user service requirements of the National ITS Architecture. The needs analysis reflected in the WSDOT strategic plan influenced the selection of functional requirements appropriate to the I-405 corridor.

ITS ELEMENTS IN ALL ALTERNATIVES

The major impacts of ITS for travelers, traffic, and freight will come from incident management and traveler information. While the exact deployment of these technologies may vary from alternative to alternative, the functional requirements will be very similar. Table 3 provides guidelines for the deployment of the major ITS functions that will be required throughout the corridor:

Table 3. Guidelines for ITS Deployment

Function	Devices	Deployment
Traveler Information *These systems allow travelers to check transportation conditions pre-trip or en-route. This should occur for all modes and provide the user enough information to make informed decisions regarding departure time, mode and alternative routes.*	• VMS	VMS at each route decision point.
	• CCTV	CCTV for view of entire roadway or secure (bus) areas with dual-camera coverage at high accident locations.
	• Loop Detection	Loops - every half to quarter mile.
	• Web Pages	Web Pages - WSDOT should maintain the WSDOT traffic Web site.
	• Data Provision to 3rd parties	Private companies provide traffic web sites or wireless services.
	• Highway Advisory Radio	Highway Advisory Radio - Length of Corridor
	• Traveler (Bus) Kiosk • Personal Computer Hardware and Software	
Incident Management and Response *This system lays a framework to rapidly and effectively respond to all incidents, including HAZMAT. It provides system managers with real-time information and a variety*	• VMS	VMS at major route decision points.
	• CCTV	CCTV as above.
	• Video Detection	Video Incident Detection with each camera.
	• Emergency Vehicle Management	Emergency vehicle management regional deployment.

Function	Devices	Deployment
of incident response strategies.	• Incident Response Teams • Central Operations Center	Incident Response Teams - one truck every 5 miles.
System Management *These systems allow system managers to communicate with drivers, monitor conditions and control freeway access.*	• VMS • Loops • CCTV • Ramp Metering • Coordination with local jurisdictions • Central Operations Center	VMS, Loops and CCTV as above. Ramp Metering, every ramp - consider dual lane metering as conditions warrant. Coordination - systemwide.
Electronic Payment *Transit, parking, HOT lanes, toll roads and congestion pricing strategies could all use these technologies to streamline payment and minimize interruption in transportation efficiency.*	• CCTV • License Plate Readers • Tag Readers • Bar Code Scanners • Smart Cards	These technologies may be deployed system-wide depending on the strategies chosen for future alternatives.

The functional requirements below are taken directly from the National ITS Architecture. This section outlines general functional requirements and provides a brief description of each.

Table 4. Functional Requirements Relevant to Corridor Program

Number	Description
1.1.0	ITS shall provide a Pre-Trip Travel Information (PTTI) capability to assist travelers in making mode choices, travel time estimates, and route decisions prior to trip departure. *1.1.0 and its subordinate functions are intended to ensure the provision of data and a means of dissemination that will provide traveler information accessible pre-trip. These can include web sites, television stations, personalized e-mails, and notifications sent to portable computers. Data will include current traffic conditions, current transit conditions, travel time estimates for various modes, trip planning, construction and incident information.*
1.2.0	ITS shall include an En-Route Driver Information (DI) function. Driver Information provides vehicle drivers with information, while en-route, which will allow alternative routes to be chosen for their destination. *This includes all information conveyed to drivers via radio, VMS or portable wireless devices such as wireless Web applications. This covers similar areas as 1.1.0, but focuses mostly on information for automobile drivers.*
1.4.0	ITS shall include a Ride Matching and Reservation (RMR) function. *Ride matching services, part of a general TDM package, are enhanced by ITS applications. Transportation web sites and services can include ride matching services. Context sensitive or opt-in carpools can make it easier to use HOV lanes when general lanes are congested due to an unusual circumstance.*

Number	Description
1.6.0	ITS shall provide a Traffic Control capability. Traffic Control provides the capability to efficiently manage the movement of traffic on streets and highways. *Traffic control uses ITS devices to regulate flow, perform traffic surveillance, and monitor signal timing or ramp metering.*
1.7.0	ITS shall include an Incident Management (IM) function. Incident Management will identify incidents, formulate response actions, and support initiation and ongoing coordination of those response actions. *There are two parts to incident management. One is incident response, towing or pushing vehicles placed along the roadway. The other is the infrastructure necessary to detect incidents, alert emergency crews and alert other drivers. 1.7.0 addresses the latter.*
2.1.0	ITS shall include a Public Transportation Management (PTM) function. *ITS will include functions that support transit.*
2.2.0	ITS shall include an En-Route Transit Information (TI) function. En-Route Transit Information provides travelers with real-time transit and high-occupancy vehicle information allowing travel alternatives to be chosen once the traveler is en-route. *Transit information should be provided while people are en-route. This could be via VMS at decision points or at park-and-rides, via radio, and via displays on the buses themselves.*
3.1.0	ITS shall include an Electronic Payment capability. Electronic Payment Services allow travelers to pay for transportation services by electronic means. *Electronic payment is already being examined in the region with the regional fare integration effort. This can extend into toll collection, parking payment, HOT lane pricing and value pricing in the I-405 corridor.*
4.1.0	ITS shall include a Commercial Vehicle Electronic Clearance (CVEC) capability. *This system can be integrated with other weigh station bypass and freight expediting systems in Washington to track vehicles and allow commercial vehicles preferential access to some facilities.*
4.5.0	ITS shall include an Hazardous Materials (HAZMAT) Incident Response (HIR) service. *These systems allow the tracking of HAZMAT vehicles, define HAZMAT response protocols and permit the detection of HAZMAT incidents.*
5.2.0	ITS shall include an Emergency Vehicle Management (EVM) Service. *This system tracks the current location and status of all emergency vehicles in the region and identifies emergency vehicles that are assigned to the I-405 corridor. The system then alerts and dispatches the closest available vehicles to an incident.*

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I-405 Communications

THE VALUE OF COMMUNICATIONS

Intelligent Transportation Systems rely heavily on a reliable communications system. Currently, ITS devices are accessed by dial-up modems, microwave transmissions, 600 to 800 MHz radio, fiber optic cable, wireless modems, and twisted pair copper cable. Bandwidth has always been a limiting factor. Bandwidth limitations often limited the progress of ITS technologies. With recent fiber optic systems implemented in the around the country and I-405 study area, bandwidth is becoming much less of an issue. It is also likely that bandwidth needs will also expand accordingly.

DESCRIPTION OF LIGHT LANES AND THE CORRIDOR

Light Lanes is a statewide fiber optic communications backbone built in a public-private partnership with Universal Communication Networks (UCN). The Light Lanes infrastructure runs through the length of I-405. Throughout the rest of the state, a majority of the ITS devices in place are connected to the Light Lanes backbone which provides statewide distribution of ITS information to WSDOT regional offices and control centers.

This is different for the I-405 corridor, which has WSDOT fiber in WSDOT conduit. Most of the ITS devices along 405 are attached to this WSDOT conduit. There are several access points to the Light Lanes fiber along the I-405 corridor, however. So there is ample communications along the corridor for any foreseeable ITS deployment.

SHORT TERM COMMUNICATIONS

In the short term (less than five years), it is likely that available basic communications systems will not radically change. Currently, the communications medium of choice is fiber optic cable like that already deployed by WSDOT and the Light Lanes project. Regardless of any other developments, the fiber optic systems being implemented today should be able to accommodate any devices implemented currently designed.

MEDIUM TERM COMMUNICATIONS

Wireless broadband communications are currently in rapid development. Wireless Web access is being introduced. Test applications of wireless broadband ITS applications, both in the traveler information and the transportation management arenas, are showing excellent results. It is likely that in the 5 to 10 year range, this type of wireless communications infrastructure will become commonplace. It is also possible that devices will begin to come with their own communications equipment. During the medium term, communications will likely take place with a combination of legacy twisted pair communications, fiber optic systems, and newer wireless systems.

LONG TERM COMMUNICATIONS

There is considerable difficulty in forecasting future communications technologies. If technology continues along its current course, it is possible that long-term communications solutions will entirely come from wireless systems. The convenience of less infrastructure, the freedom from buried cable, and the lower maintenance costs would all be benefits from such a system.

National ITS Architecture Information

NATIONAL ITS ARCHITECTURE

The functional requirements presented in this report come directly out of the National ITS Architecture[1]. Future planning exercises to locate technologies will be able to use the functional requirements as a starting point. Given that there is currently no regional architecture for the corridor, this document is currently in conformance with the National ITS Architecture.

REGIONAL ARCHITECTURE

The Puget Sound Regional Council is currently creating a Regional Architecture. When the I-405 Corridor Program moves out of the programmatic phase and into the project level phase, ITS deployments identified will need to agree with that architecture. Therefore, the planners at that time will need to coordinate with PSRC. If the final plans for the I-405 Corridor Program do not agree with the Regional Architecture, there is a possibility that federal funding for those elements will be jeopardized.

[1] U.S. Department of Transportation, National ITS Architecture Version 3.0

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APPENDIX F
Construction Impacts Memorandum

I-405 CORRIDOR PROGRAM

Technical Memorandum on Construction Impacts

Criteria Influencing Traffic Flow during Construction

Implementation of proposed improvements under any of the "build" scenarios for the I-405 Corridor Program will add to the existing Eastside and regional traffic problems during construction. The degree of impacts will depend on the location, extent, and duration of the projects selected for the preferred alternative. Following are some of the factors that will impact traffic management during construction:

- Local agencies have requested alternatives be pursued that minimize impacts on neighborhoods and right-of-way takes. Alternatives have been developed that require new construction adjacent to the existing facilities, requiring lane-closures, detours, and shifts in traffic to adjacent roadways.
- The size of the corridor (256 square miles) and number of projects will require phasing based on availability of funding and construction sequencing requirements. For a corridor program of this magnitude, it is likely that construction will take more than 15 years to complete.
- Many locations throughout the corridor have severe right-of-way restrictions (for example in downtown Renton or Bellevue) that reduce opportunities to provide detours. There is a lack of adequate parallel arterial/freeway systems that will allow for diversion of traffic during construction.
- More than 90 bridges will require widening or replacement for any of the "build" alternatives, resulting in capacity restrictions for both the facility being improved as well as the facility it crosses.
- There are only three lanes in each direction on I-405 between Tukwila and I-90. Construction impacts to traffic in this highly congested segment will be worse than for other segments that have more lanes.
- High Capacity Transit traffic impacts will vary depending on selection of the preferred alignments. Alternatives include at-grade, elevated, and tunnel sections that are located on existing BNSF, arterial, or freeway alignments.

Construction Impacts for Alternatives

On an annual basis, construction impact will be similar for all "build" alternatives because efforts will be made to maintain existing traffic lanes during construction. However, the duration of construction in years will vary depending on the selected alternative. Most likely, phasing of the projects will be required to match available funding and to minimize the extent of traffic impacts. For example, under Alternative 2, adding one lane in each direction on I-405 will require about four to six years to construct for each segment. For Alternative 4, adding three lanes in each direction may require six to ten years to construct for each segment because of the increased cost and complexity. Therefore traffic impacts related to construction activities will be nearly two times greater for Alternative 2 compared to Alternative 4.

For comparative purposes, the following chart shows the new lane miles of roadway per alternative. Traffic impacts during construction will increase in relationship to the increase in added lanes when comparing alternatives.

	ALTERNATIVES				
	1	2	3	4	5
	HCT/TDM	Mixed Mode with HCT/Transit Emphasis	Mixed Mode	General Capacity	No Action
Arterials	70	113	139	145	54
% New Art.	5%	7%	9%	9%	3%
Freeway	49	147	195	350	27
% New Fwy.	9%	28%	37%	67%	5%
Total New	**119**	**260**	**334**	**495**	**81**
% New	**6%**	**13%**	**16%**	**24%**	**4%**

Anticipated Construction Impacts on Traffic

A travel model was run to show the impacts of converting one general-purpose lane in each direction to alternative modes. This model run approximates the impacts of lane narrowing and implementation of detours during construction. Key findings from this analysis indicate that there will be spill-over on parallel arterial routes, a decrease in VMT within the study area along with a corresponding increase in VMT in the I-5 corridor, and an increase in work trips by transit/HOV. Key findings in the analysis include:

- Total study area screenline volumes are reduced by 10-15% (compared to 2020 No Action) due to limited I-405 capacity.
- Spill-over occurs on parallel arterial routes (10-25% higher on several arterials.)

- I-405 volumes decrease by 35,000-50,000 vehicles per day. Up to half of this volume shifted to the I-5 corridor, particularly in the south end of Seattle.
- Overall traffic reliability is significantly worsened on I-405 due to added congestion and reduced lane changing options. Arterials are similarly affected.
- Congestion significantly worsens on I-405 and other study area freeways.
- A 25% increase in daily work trips by transit/HOV compared to 2020 No-Action.

Construction Methods for Roadways

In the Puget Sound Region, due to high traffic volumes, state and local agencies have made it a practice to maintain existing traffic flow to the extent possible during construction. Project phasing and sequencing, and methods to speed construction will be critical for minimizing traffic impacts. Potential measures to lessen traffic impacts will include:

- Providing a Construction Traffic Manager and Traffic Management Team with full time responsibilities to develop measures to minimize traffic delays and disruptions.
- Implementing Intelligent Transportation System (ITS) technologies in advance of, and during construction to inform the public, reduce demand, and manage traffic flow.
- Implementing Transportation System Management (TSM) and Transportation Demand Management (TDM) strategies aimed at increasing vehicle occupancy and reducing travel demand.
- Sequencing construction packages to assure parallel systems in corridor segments are complimentary, for example widening an arterial prior to widening an adjacent freeway section.
- Coordinating traffic control with local agencies and other transportation projects in the region, for example, assuring that major reconstruction on I-5 will not occur at the same time as reconstruction of I-405.
- Coordinating construction activities with transit agencies, police, fire, and emergency service providers.
- Disseminating information to local businesses and the general public regarding construction activities, road closures, and alternative modes of travel.
- Maintaining a construction information hot-line to resolve problems and respond to questions from the public regarding construction delays and activities.
- During the design phase, utilizing construction experts to evaluate methods that can shorten contract duration and minimize impacts.
- Providing monetary incentives to contractors to shorten construction times.
- Allowing full-time road closures to speed construction when appropriate.

- Providing construction staging areas and access to work sites that minimized disruption to general traffic
- Holding community meetings during construction to receive public feedback and input on construction impacts and delays.
- Providing remote park-and-ride with shuttle transit for access to large employment/activity centers.
- Restricting lane closures and construction activities that impact traffic during peak commuter hours.
- Utilizing moveable barriers for lane closures where appropriate to allow full roadway utilization during peak periods.
- Restricting construction activities during peak holiday travel periods.

Construction Methods for HCT/Transit

Construction of the HCT system involves work on BNSF right-of-way as well as within existing freeway and arterial right-of-way. Unlike roadway construction, HCT sections would most likely be opened at one time. Park-and-ride facilities will be dispersed throughout the study area with shorter term impacts. Methods to lessen traffic impacts for HCT segments include the methods described above for roadways, and will also include:

- Delivering roadbed materials and other components by rail and/or truck using the HCT right-of-way when feasible.
- Using standard designs and construction methods for stations that result in quick completion.
- Allowing for road closures during non-peak periods to complete critical segments.

APPENDIX G
Tolls on Express Lanes

Analysis of Tolls on Express Lanes in Alternative 4

INTRODUCTION

A sensitivity test was conducted for Alternative 4 assuming that the express roadway was converted into a toll facility. The purpose of the analysis was to determine if demand for the express roadway could be managed using a pricing mechanism. This test assumed that a toll would be charged on a per-mile basis, with varying rates during the AM, PM and off-peak periods. The analysis did not assume a variable rate by user type (e.g. HOV, freight, SOV), although this could certainly be an option. The analysis concludes with preliminary estimates of toll revenues that could accrue from such an operation.

ESTIMATING AN OPTIMAL TOLL

An estimate was made for a range of optimal toll rates that could be applied to the Express Lanes under Alternative 4. In consultation with PSRC staff, a simplified procedure was adapted from the methodology suggested by ECO Northwest[1] and implemented by PSRC for an analysis of optimizing roadway pricing. These results were summarized in a Technical Memorandum, *General Capacity Alternative (Alternative 4) with Toll on Express Lanes* (January 2001) appended to the end of this summary.

The pricing procedure translates a given toll into an equivalent travel time delay. This is a common approach used in modeling to account for the effects of pricing. PSRC staff internalized this concept by feeding the modified travel times (reflecting a travel time delay equivalent to the value of the toll) from the traffic assignment process back into the mode choice process for several income classes.

By assuming an average value for travel time, one can then associate an optimal toll rate (in cents per mile of travel) corresponding to the estimated “toll time” values. Based on a survey of the value of travel time estimated for similar studies across the country, an estimate of $7 to $ 8 per hour seemed reasonable for this study. This results in the production of the following toll rate estimates for the Express Lanes:

- 8 to 10 cents per mile for AM peak period;
- 25 to 35 cents per mile for PM peak period; and
- 5 to 7 cents per mile for off-peak period.

[1] “Puget Sound Regional Council Transportation Pricing Alternatives Study,” Technical Memorandum 3 prepared by ECO Northwest, February 19, 2000.

The analysis did not estimate varying rates for heavy vs. light vehicles or for other classes of users.   These tolls do not translate directly into achieving a certain quality of travel on the express lanes, although one objective of the methodology is to maintain reasonable travel flows on the lanes that are tolled.

TRAFFIC EFFECTS OF TOLL

The 2020 travel model was rerun using the tolls documented above. The tolls were translated into equivalent travel time delays, with the result that traffic volumes shifted from the toll facility back to other roadways. The general effects of these shifts are discussed in the following sections.

I-405 Effects

The effects of the tolls on the I-405 daily traffic volumes are shown in Table 1. Overall, the volumes on the express lanes were reduced by 30-40 percent, or around 25,000-35,000 vehicles per day (vpd). A relatively small shift in volume occurred back to the mainline I-405, with volumes increasing by less than 10%. Overall daily volumes on I-405 were reduced by around 10% (i.e. around 20,000 –30,000 vpd). The resulting volumes along I-405 with tolls would be similar to the volumes forecasted for Alternative 3.

Regional Effects

The effects of the tolls were examined across the study area and regional screenlines developed for the I-405 Corridor Program. Within the study area, screenline volumes typically dropped by 5% or less.   This occurred for travel in the north-south as well as the east-west directions. There was a slight tendency for north-south volumes on major arterials to increase. More people would opt for the arterials in lieu of the toll facility.

The forecasts showed some diversion back to the I-5 corridor, although overall volume increases along Seattle screenlines were generally in the 1-2% range.   The south end tended to show somewhat higher shifts to I-5, while volumes in the north end of Seattle changed very little.

These results would indicate that the effects of tolling the express roadway on I-405 would cause minimal changes in regional travel patterns or corridor demands.   One conclusion could be that trips removed from the express roadway due to tolls would show up as shorter trips within the study area, or trips rerouted to other destinations. Additional analysis of the toll sensitivities to travel behavior and trip patterns would be necessary should the toll concept be advanced further within the I-405 corridor program.

REVENUE ESTIMATES

Using the toll rates described previously, it is estimated that $70-80 Million in annual revenues could be achieved along the I-405 express roadway. These estimates are very preliminary and do not account for potential rate adjustments by user class.

Table 1- Comparative Analysis of Alternative 4 Volumes on I-405 with and without Tolls

Screenline Number	Location on I-405	2020 Alternative 4 Mainline	2020 Alternative 4 Express	2020 Alternative 4 Total	2020 Alternative 4 w/Toll on Express Mainline	2020 Alternative 4 w/Toll on Express Express	2020 Alternative 4 w/Toll on Express Total	Mainline Change vs. Alt 4 No Toll	Express Lane Change vs. Alt 4 No Toll	Total Change vs. Alt 4 No Toll
1	South of SR 524	162,396		162,396	147,125		147,125	NA	NA	-9%
24	South of 228th St SE	123,257	74,780	198,037	134,034	47,021	81,055	9%	-37%	-9%
13	South of County Line	123,147	74,780	197,927	133,979	47,021	181,000	9%	-37%	-9%
14	South of NE 124th St	190,161	82,520	272,681	194,543	55,706	250,249	2%	-32%	-8%
25	North of NE 85th St	212,066	82,520	294,586	215,355	55,706	271,060	2%	-32%	-8%
15	South of NE 70th St	177,154	95,343	272,497	184,078	62,776	246,854	4%	-34%	-9%
16	South of Main St (Bellevue)	231,559	95,343	326,902	235,525	62,776	298,301	2%	-34%	-9%
17	South of SE 60th St	184,005	103,314	287,319	185,821	70,438	256,259	1%	-32%	-11%
20	South of SR 169	189,242	103,314	292,556	196,277	70,438	266,715	4%	-32%	-9%
22	East of SR 181	171,875	78,373	250,249	181,382	51,642	233,025	6%	-34%	-7%

Appendix A

Travel Forecasting Methodology and Results for Toll on I-405 Express Roadway

BACKGROUND

This memorandum includes summary analysis results from an additional modeling exercise performed as part of the I-405 study to estimate a range of optimal toll rates that could possibly be applied along the Express Lanes under Alternative 4. This sensitivity test was part of a strategy to manage overall traffic levels under this Alternative. In consultation with the PSRC staff, a simplified procedure was adapted from the methodology suggested by ECO Northwest[2] and implemented by PSRC for analysis of optimizing roadway pricing.

The pricing procedure relies on inclusion of an additional "impedance increment (in the form of a toll) [3]". PSRC staff have internalized this concept by feeding the "augmented" link travel time (reflecting a travel time equivalent to a toll delay) from the assignment process back into the mode choice process for each income class. The simplified procedure used here on the I-405 project has relied only on using the "augmented" link travel times from the assignment step and rerunning of the existing PSRC traffic assignments module without using the more involved "feed-back" process into mode choice.

TOLL APPLICATION

Assignment results from the PSRC model reflecting the "augmented" travel times (for the links representing the proposed Express Lanes) were used to calculate volume over capacity (V/C) ratios for representative links along the proposed Express Lanes for each time period (i.e., AM peak, PM peak, and off-peak) as shown in Table A. In consultation with ECO Northwest staff, these V/C ratios were used to estimate a range of optimal toll rates for the proposed Express Lanes. The process involved using the V/C ratios (shown in Table A) in the original and "augmented" volume-delay functions for each time period to estimate respective link travel times. The difference in the resulting travel times can be considered an estimate for the optimal "toll time" on each link (see Table B). By assuming an average value for travel time, one can then associate an optimal toll rate (in cents per mile of travel in Table C) corresponding to the estimated "toll time" values (shown in Table B). Based on a

[2] "Puget Sound Regional Council Transportation Pricing Alternatives Study," Technical Memorandum 3 prepared by ECONorthwest, February 19, 2000.

[3] Ibid. (page 2)

survey of the value of travel time estimated for similar studies across the country, an estimate of $7 to $ 8 per hour seemed reasonable for this study. This results in the production of the following toll rate estimates for the Express Lanes:

- 8 to 10 cents per mile for AM peak period;
- 25 to 35 cents per mile for PM peak period; and
- 5 to 7 cents per mile for off-peak period.

Table A. V/C ratios for Alternative 4 with Toll on Express Lanes

Express Lanes Segment	Direction	AM Peak Period	PM Peak Period	OP Peak Period
North of 160th St	SB	0.67	0.51	0.55
	NB	0.22	0.86	0.34
North of 70th St	SB	0.71	0.60	0.55
	NB	0.34	1.01	0.48
Bellevue	SB	0.57	0.88	0.57
	NB	0.59	0.82	0.64
North of Renton CBD	SB	0.64	1.00	0.65
	NB	0.65	0.85	0.71
West of SR-167	SB	0.61	0.57	0.46
	NB	0.50	0.80	0.53
Simple Average		**0.55**	**0.79**	**0.55**

Table B. Toll Delay (in minutes) for Alternative 4 with Toll on Express Lanes.

Express Lanes Segment	Direction	AM Peak Period	PM Peak Period	OP Peak Period
North of 160th St	SB	0.79	0.28	0.37
	NB	0.01	2.25	0.05
North of 70th St	SB	1.01	0.51	0.37
	NB	0.05	4.11	0.20
Bellevue	SB	0.61	3.32	0.58
	NB	0.69	2.50	0.93
North of Renton CBD	SB	1.02	5.89	1.05
	NB	1.04	3.08	1.51
West of SR-167	SB	0.08	0.06	0.03
	NB	0.04	0.26	0.05
Overall Average		**0.63**	**2.66**	**0.59**

Note: The overall average estimates were calculated by using link volumes as weights.

Table C. Optimal Tolls at Various Traffic Volumes and Time Values (55 mph design speed highway)

Volume-Capacity Ratio	Time Toll (minutes)	Toll/mile @ $5/hr	Toll/mile @ $10/hr	Toll/mile @ $15/hr
0.0	0.000	-	-	-
0.1	0.000	0.000	0.000	0.000
0.2	0.001	0.000	0.000	0.000
0.3	0.005	0.000	0.001	0.001
0.4	0.017	0.001	0.003	0.004
0.5	0.041	0.003	0.007	0.010
0.6	0.085	0.007	0.014	0.021
0.7	0.157	0.013	0.026	0.039
0.8	0.268	0.022	0.045	0.067
0.9	0.429	0.036	0.072	0.107
1.0	0.655	0.055	0.109	0.164
1.1	0.958	0.080	0.160	0.240
1.2	1.357	0.113	0.226	0.339

Source: Pozdena, R., and PSRC Pricing

APPENDIX H

Transportation Data

APPENDIX H: TRANSPORTATION DATA

Table 1a - PM Peak Period Person Trips at Selected Screenlines

	Express Lanes		I-405					Parallel Arterials				Screenline	
Screenline	Non-HOV	Total	Non-HOV	HOV	Bus Transit	HCT Transit	Total	Non-HOV	HOV	Bus Transit	Total	Transit	Total
Bothell, South of the County Line (80th Ave. NE to SR 522)													
1995			29,300	1,300	200	N/A	30,800	39,700	400	100	40,200	300	71,000
Modal Share (%)			95%	4%	1%	N/A	100%	99%	1%	0%	100%	0%	
2020 No-Action Unconstr.							55,600				51,800		107,400
Modal Share (%)							100%				100%		
2020 No-Action			32,900	8,600	400	N/A	41,900	49,000	2,900	200	52,100	600	94,000
Modal Share (%)			79%	21%	1%	N/A	100%	94%	6%	0%	100%	1%	
2020 HCT/TDM (Alt. 1)			32,900	8,600	100	1,400	43,000	49,100	2,900	100	52,100	1,600	95,100
Modal Share (%)			77%	20%	0%	3%	100%	94%	6%	0%	100%	2%	
2020 Transit (Alt. 2)			45,900	9,200	100	1,500	56,700	49,300	2,900	100	52,300	1,700	109,000
Modal Share (%)			81%	16%	0%	3%	100%	94%	6%	0%	100%	2%	
2020 Mixed Mode (Alt. 3)			57,200	9,200	800	N/A	67,200	49,900	2,600	100	52,600	900	119,800
Modal Share (%)			85%	14%	1%	N/A	100%	95%	5%	0%	100%	1%	
2020 General Capacity (Alt. 4)	24,700	24,700	41,300	9,200	700	N/A	51,200	49,000	2,600	200	51,800	900	127,700
Modal Share (%)	100%	100%	81%	18%	1%	N/A	100%	95%	5%	0%	100%	1%	

NOTES:
1) Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
2) HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
3) Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 1b - PM Peak Period Person Trips at Selected Screenlines

	Express Lanes		I-405					Parallel Arterials				Screenline	
Screenline	Non-HOV	Total	Non-HOV	HOV	Bus Transit	HCT Transit	Total	Non-HOV	HOV	Bus Transit	Total	Transit	Total
Bellevue, South of NE 8th St. (Bellevue Wy to 156th Ave.)													
1995			53,100	2,300	200	N/A	55,600	49,700	400	700	50,800	900	106,400
Modal Share (%)			96%	4%	0%	N/A	100%	98%	1%	1%	100%	1%	
2020 No-Action Unconstr.							102,300				59,400		161,700
Modal Share (%)							100%				100%		
2020 No-Action			53,800	19,300	300	N/A	73,400	64,000	1,000	3,600	68,600	3,900	142,000
Modal Share (%)			73%	26%	0%	N/A	100%	93%	1%	5%	100%	3%	
2020 HCT/TDM (Alt. 1)			53,200	18,900	100	9,200	81,400	64,200	1,000	800	66,000	10,100	147,400
Modal Share (%)			65%	23%	0%	11%	100%	97%	2%	1%	100%	7%	
2020 Transit (Alt. 2)			73,300	19,300	100	9,500	102,200	59,600	1,000	800	61,400	10,400	163,600
Modal Share (%)			72%	19%	0%	9%	100%	97%	2%	1%	100%	6%	
2020 Mixed Mode (Alt. 3)			92,200	19,900	6,800	N/A	118,900	55,600	1,300	1,800	58,700	8,600	177,600
Modal Share (%)			78%	17%	6%	N/A	100%	95%	2%	3%	100%	5%	
2020 General Capacity (Alt. 4)	32,200	32,200	72,000	20,500	300	N/A	92,800	52,900	1,000	3,900	57,800	4,200	182,800
Modal Share (%)	100%	100%	78%	22%	0%	N/A	100%	92%	2%	7%	100%	2%	

NOTES:
1) Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
2) HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
3) Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 1c - PM Peak Period Person Trips at Selected Screenlines

Screenline	Express Lanes Non-HOV	Express Lanes Total	I-405 Non-HOV	I-405 HOV	I-405 Bus Transit	I-405 HCT Transit	I-405 Total	Parallel Arterials Non-HOV	Parallel Arterials HOV	Parallel Arterials Bus Transit	Parallel Arterials Total	Screenline Transit	Screenline Total
Renton, West of Renton CBD (SR 900 to SW 43rd St.)													
1995			32,100	3,200	-	N/A	35,300	38,500	400	1,300	40,200	1,300	75,500
Modal Share (%)			91%	9%	0%	N/A	100%	96%	1%	3%	100%	2%	
2020 No-Action Unconstr.							81,400				49,800		131,200
Modal Share (%)							100%				100%		
2020 No-Action			30,000	20,800	200	N/A	51,000	48,300	1,300	1,500	51,100	1,700	102,100
Modal Share (%)			59%	41%	0%	N/A	100%	95%	3%	3%	100%	2%	
2020 HCT/TDM (Alt. 1)			30,200	20,200	-	1,700	52,100	48,200	1,000	1,400	50,600	3,100	102,700
Modal Share (%)			58%	39%	0%	3%	100%	95%	2%	3%	100%	3%	
2020 Transit (Alt. 2)			50,200	19,900	-	1,800	71,900	44,900	1,000	1,300	47,200	3,100	119,100
Modal Share (%)			70%	28%	0%	3%	100%	95%	2%	3%	100%	3%	
2020 Mixed Mode (Alt. 3)			68,400	20,500	700	N/A	89,600	43,800	1,000	1,400	46,200	2,100	135,800
Modal Share (%)			76%	23%	1%	N/A	100%	95%	2%	3%	100%	2%	
2020 General Capacity (Alt. 4)	23,300	23,300	50,700	20,800	200	N/A	71,700	42,200	1,300	1,600	45,100	1,800	140,100
Modal Share (%)	100%	100%	71%	29%	0%	N/A	100%	94%	3%	4%	100%	1%	

NOTES:
1) Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
2) HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
3) Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 2a - Daily Person Trips at Selected Screenlines

Screenline	Express Lanes Non-HOV	Express Lanes Total	I-405 Non-HOV	I-405 HOV	I-405 Bus Transit	I-405 HCT Transit	I-405 Total	Parallel Arterials Non-HOV	Parallel Arterials HOV	Parallel Arterials Bus Transit	Parallel Arterials Total	Screenline Transit	Screenline Total
Bothell, South of the County Line (80th Ave. NE to SR 522)													
1995			100,500	2,900	300	N/A	103,700	122,300	700	200	123,200	500	226,900
Modal Share (%)			97%	3%	0%	N/A	100%	99%	1%	0%	100%	0%	
2020 No-Action Unconstr.							213,400				127,000		340,400
Modal Share (%)													
2020 No-Action			115,000	20,200	1,100	N/A	136,300	153,400	7,300	500	161,200	1,600	297,500
Modal Share (%)			84%	15%	1%	N/A	100%	95%	5%	0%	100%	1%	
2020 HCT/TDM (Alt. 1)			114,700	19,900	200	4,200	139,000	153,400	7,600	100	161,100	4,500	300,100
Modal Share (%)			83%	14%	0%	3%	100%	95%	5%	0%	100%	1%	
2020 Transit (Alt. 2)			154,900	21,500	200	4,500	181,100	151,300	7,300	100	158,700	4,800	339,800
Modal Share (%)			86%	12%	0%	2%	100%	95%	5%	0%	100%	1%	
2020 Mixed Mode (Alt. 3)			186,800	21,800	2,700	N/A	211,300	153,000	7,000	300	160,300	3,000	371,600
Modal Share (%)			88%	10%	1%	N/A	100%	95%	4%	0%	100%	1%	
2020 General Capacity (Alt. 4)	82,400	82,400	130,400	21,800	1,900	N/A	154,100	151,000	7,000	600	158,600	2,500	395,100
Modal Share (%)	100%	100%	85%	14%	1%	N/A	100%	95%	4%	0%	100%	1%	

NOTES:
1) Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
2) HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
3) Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 2b - Daily Person Trips at Selected Screenlines

	Express Lanes		I-405					Parallel Arterials				Screenline	
Screenline	Non-HOV	Total	Non-HOV	HOV	Bus Transit	HCT Transit	Total	Non-HOV	HOV	Bus Transit	Total	Transit	Total
Bellevue, South of NE 8th St. (Bellevue Wy to 156th Ave.)													
1995			181,200	5,100	600	N/A	186,900	131,500	400	2,200	134,100	2,800	321,000
Modal Share (%)			97%	3%	0%	N/A	100%	98%	0%	2%	100%	1%	
2020 No-Action Unconstr.							382,800				109,400		492,200
Modal Share (%)							100%				100%		
2020 No-Action			183,900	48,200	800	N/A	232,900	186,800	2,300	12,900	202,000	13,700	434,900
Modal Share (%)			79%	21%	0%	N/A	100%	92%	1%	6%	100%	3%	
2020 HCT/TDM (Alt. 1)			181,600	47,000	100	28,500	257,200	188,100	2,300	2,300	192,700	30,900	449,900
Modal Share (%)			71%	18%	0%	11%	100%	98%	1%	1%	100%	7%	
2020 Transit (Alt. 2)			244,600	47,600	100	29,800	322,100	169,600	2,900	2,300	174,800	32,200	496,900
Modal Share (%)			76%	15%	0%	9%	100%	97%	2%	1%	100%	6%	
2020 Mixed Mode (Alt. 3)			308,100	48,600	23,400	N/A	380,100	146,500	3,200	6,500	156,200	29,900	536,300
Modal Share (%)			81%	13%	6%	N/A	100%	94%	2%	4%	100%	6%	
2020 General Capacity (Alt. 4)	103,400	103,400	238,400	50,100	1,000	N/A	289,500	140,100	2,600	13,700	156,400	14,700	549,300
Modal Share (%)	100%	100%	82%	17%	0%	N/A	100%	90%	2%	9%	100%	3%	

NOTES:
1) Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
2) HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
3) Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 2c - Daily Person Trips at Selected Screenlines

	Express Lanes		I-405					Parallel Arterials				Screenline	
Screenline	Non-HOV	Total	Non-HOV	HOV	Bus Transit	HCT Transit	Total	Non-HOV	HOV	Bus Transit	Total	Transit	Total
Renton, West of Renton CBD (SR 900 to SW 43rd St.)													
1995			111,900	7,600	-	N/A	119,500	115,100	700	4,400	120,200	4,400	239,700
Modal Share (%)			94%	6%	0%	N/A	100%	96%	1%	4%	100%	2%	
2020 No-Action Unconstr.							306,300				155,800		462,100
Modal Share (%)							100%				100%		
2020 No-Action			116,200	47,900	600	N/A	164,700	139,800	3,200	4,500	147,500	5,100	312,200
Modal Share (%)			71%	29%	0%	N/A	100%	95%	2%	3%	100%	2%	
2020 HCT/TDM (Alt. 1)			115,000	46,400	-	6,800	168,200	139,800	2,300	3,900	146,000	10,700	314,200
Modal Share (%)			68%	28%	0%	4%	100%	96%	2%	3%	100%	3%	
2020 Transit (Alt. 2)			184,500	47,600	-	7,200	239,300	130,700	1,900	3,800	136,400	11,000	375,700
Modal Share (%)			77%	20%	0%	3%	100%	96%	1%	3%	100%	3%	
2020 Mixed Mode (Alt. 3)			239,400	48,200	2,800	N/A	290,400	123,200	1,900	4,400	129,500	7,200	419,900
Modal Share (%)			82%	17%	1%	N/A	100%	95%	1%	3%	100%	2%	
2020 General Capacity (Alt. 4)	86,500	86,500	171,900	49,500	500	N/A	221,900	119,100	3,200	5,600	127,900	6,100	436,300
Modal Share (%)	100%	100%	77%	22%	0%	N/A	100%	93%	3%	4%	100%	1%	

NOTES:
1) Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
2) HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
3) Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 3a - PM Peak Vehicle Trips at Selected Screenlines

	Express Lanes				I-405				Parallel Arterials				Screenline
Screenline	Non-HOV	HOV	Comm.	Total	Non-HOV	HOV	Commercial	Total	Non-HOV	HOV	Commercial	Total	Total
Bothell, South of the County Line (80th Ave. NE to SR 522)													
1995					22,000	400	2,100	24,500	29,800	100	2,000	31,900	56,400
Share by Facility (%)								43%				57%	100%
2020 No-Action Unconstr.								40,200				38,900	79,100
Share by Facility (%)								51%				49%	100%
2020 No-Action					24,700	2,700	2,100	29,500	36,800	900	1,800	39,500	69,000
Share by Facility (%)								43%				57%	100%
2020 HCT/TDM (Alt. 1)					24,700	2,700	2,100	29,500	36,900	900	1,800	39,600	69,100
Share by Facility (%)								43%				57%	100%
2020 Transit (Alt. 2)					34,500	2,900	3,000	40,400	37,000	900	1,900	39,800	80,200
Share by Facility (%)								50%				50%	100%
2020 Mixed Mode (Alt. 3)					43,000	2,900	3,700	49,600	37,500	800	1,900	40,200	89,800
Share by Facility (%)								55%				45%	100%
2020 General Capacity (Alt. 4)	18,500	-	1,600	20,100	31,000	2,900	2,700	36,600	36,800	800	2,000	39,600	96,300
Share by Facility (%)				21%				38%				41%	100%

NOTES:
- The information presented in this table was directly produced by the model without any post-processing analysis.
- Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
- HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
- Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 3b - PM Peak Vehicle Trips at Selected Screenlines

	Express Lanes				I-405				Parallel Arterials				Screenline
Screenline	Non-HOV	HOV	Comm.	Total	Non-HOV	HOV	Commercial	Total	Non-HOV	HOV	Commercial	Total	Total
Bellevue, South of NE 8th St. (Bellevue Wy to 156th Ave.)													
1995					39,900	700	3,500	44,100	37,300	100	2,600	40,000	84,100
Share by Facility (%)								52%				48%	100%
2020 No-Action Unconstr.								73,200				37,200	110,400
Share by Facility (%)								66%				34%	100%
2020 No-Action					40,400	6,100	3,200	49,700	48,100	300	3,400	51,800	101,500
Share by Facility (%)								49%				51%	100%
2020 HCT/TDM (Alt. 1)					40,000	6,000	3,200	49,200	48,200	300	3,400	51,900	101,100
Share by Facility (%)								49%				51%	100%
2020 Transit (Alt. 2)					55,100	6,100	4,600	65,800	44,800	300	3,400	48,500	114,300
Share by Facility (%)								58%				42%	100%
2020 Mixed Mode (Alt. 3)					69,300	6,300	6,200	81,800	41,800	400	3,200	45,400	127,200
Share by Facility (%)								64%				36%	100%
2020 General Capacity (Alt. 4)	24,200	-	2,400	26,600	54,100	6,500	4,900	65,500	39,700	300	2,900	42,900	135,000
Share by Facility (%)				20%				49%				32%	100%

NOTES:
- The information presented in this table was directly produced by the model without any post-processing analysis.
- Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
- HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
- Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 3c - PM Peak Vehicle Trips at Selected Screenlines

Screenline	Express Lanes Non-HOV	HOV	Comm.	Total	I-405 Non-HOV	HOV	Commercial	Total	Parallel Arterials Non-HOV	HOV	Commercial	Total	Screenline Total
Renton, West of Renton CBD (SR 900 to SW 43rd St.)													
1995					24,100	1,000	2,200	27,300	28,900	100	2,100	31,100	58,400
Share by Facility (%)								47%				53%	100%
2020 No-Action Unconstr.								55,900				38,600	94,500
Share by Facility (%)								59%				41%	100%
2020 No-Action					22,500	6,600	2,100	31,200	36,300	400	3,000	39,700	70,900
Share by Facility (%)								44%				56%	100%
2020 HCT/TDM (Alt. 1)					22,700	6,400	2,100	31,200	36,200	300	3,000	39,500	70,700
Share by Facility (%)								44%				56%	100%
2020 Transit (Alt. 2)					37,700	6,300	3,400	47,400	33,700	300	2,900	36,900	84,300
Share by Facility (%)								56%				44%	100%
2020 Mixed Mode (Alt. 3)					51,400	6,500	4,500	62,400	32,900	300	2,800	36,000	98,400
Share by Facility (%)								63%				37%	100%
2020 General Capacity (Alt. 4)	17,500	-	1,700	19,200	38,100	6,600	3,400	48,100	31,700	400	2,800	34,900	102,200
Share by Facility (%)				19%				47%				34%	100%

NOTES:
- The information presented in this table was directly produced by the model without any post-processing analysis.
- Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
- HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
- Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 4a - Daily Vehicle Trips at Selected Screenlines

Screenline	Express Lanes Non-HOV	HOV	Comm.	Total	I-405 Non-HOV	HOV	Commercial	Total	Parallel Arterials Non-HOV	HOV	Commercial	Total	Screenline Total
Bothell, South of the County Line (80th Ave. NE to SR 522)													
1995					75,500	900	16,500	92,900	91,900	200	11,100	103,200	196,100
Share by Facility (%)								47%				53%	100%
2020 No-Action Unconstr.								184,600				103,600	288,200
Share by Facility (%)								64%				36%	100%
2020 No-Action					86,400	6,400	16,200	109,000	115,300	2,300	12,600	130,200	239,200
Share by Facility (%)								46%				54%	100%
2020 HCT/TDM (Alt. 1)					86,200	6,300	16,200	108,700	115,300	2,400	12,600	130,300	239,000
Share by Facility (%)								45%				55%	100%
2020 Transit (Alt. 2)					116,400	6,800	22,800	146,000	113,700	2,300	12,300	128,300	274,300
Share by Facility (%)								53%				47%	100%
2020 Mixed Mode (Alt. 3)					140,400	6,900	27,500	174,800	115,000	2,200	12,700	129,900	304,700
Share by Facility (%)								57%				43%	100%
2020 General Capacity (Alt. 4)	61,900	-	13,000	74,900	98,000	6,900	18,400	123,300	113,500	2,200	12,700	128,400	326,600
Share by Facility (%)				23%				38%				39%	100%

NOTES:
- The information presented in this table was directly produced by the model without any post-processing analysis.
- Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
- HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
- Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 4b - Daily Vehicle Trips at Selected Screenlines

Screenline	Express Lanes Non-HOV	Express Lanes HOV	Express Lanes Comm.	Express Lanes Total	I-405 Non-HOV	I-405 HOV	I-405 Commercial	I-405 Total	Parallel Arterials Non-HOV	Parallel Arterials HOV	Parallel Arterials Commercial	Parallel Arterials Total	Screenline Total
Bellevue, South of NE 8th St. (Bellevue Wy to 156th Ave.)													
1995					136,200	1,600	27,200	165,000	98,800	100	15,300	114,200	279,200
Share by Facility (%)								59%				41%	100%
2020 No-Action Unconstr.								330,200				81,700	411,900
Share by Facility (%)								80%				20%	100%
2020 No-Action					138,200	15,300	25,700	179,200	140,400	700	23,500	164,600	343,800
Share by Facility (%)								52%				48%	100%
2020 HCT/TDM (Alt. 1)					136,500	14,900	25,600	177,000	141,400	700	23,800	165,900	342,900
Share by Facility (%)								52%				48%	100%
2020 Transit (Alt. 2)					183,900	15,100	36,000	235,000	127,500	900	23,100	151,500	386,500
Share by Facility (%)								61%				39%	100%
2020 Mixed Mode (Alt. 3)					231,600	15,400	48,000	295,000	110,100	1,000	19,600	130,700	425,700
Share by Facility (%)								69%				31%	100%
2020 General Capacity (Alt. 4)	77,700	-	17,700	95,400	179,200	15,900	36,600	231,700	105,300	800	18,500	124,600	451,700
Share by Facility (%)				21%				51%				28%	100%

NOTES:
- The information presented in this table was directly produced by the model without any post-processing analysis.
- Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
- HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
- Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 4c - Daily Vehicle Trips at Selected Screenlines

Screenline	Express Lanes Non-HOV	Express Lanes HOV	Express Lanes Comm.	Express Lanes Total	I-405 Non-HOV	I-405 HOV	I-405 Commercial	I-405 Total	Parallel Arterials Non-HOV	Parallel Arterials HOV	Parallel Arterials Commercial	Parallel Arterials Total	Screenline Total
Renton, West of Renton CBD (SR 900 to SW 43rd St.)													
1995					84,100	2,400	16,700	103,200	86,500	200	14,900	101,600	204,800
Share by Facility (%)								50%				50%	100%
2020 No-Action Unconstr.								262,400				131,900	394,300
Share by Facility (%)								67%				33%	100%
2020 No-Action					87,300	15,200	17,700	120,200	105,100	1,000	19,900	126,000	246,200
Share by Facility (%)								49%				51%	100%
2020 HCT/TDM (Alt. 1)					86,400	14,700	17,600	118,700	105,100	700	19,900	125,700	244,400
Share by Facility (%)								49%				51%	100%
2020 Transit (Alt. 2)					138,700	15,100	27,800	181,600	98,200	600	18,600	117,400	299,000
Share by Facility (%)								61%				39%	100%
2020 Mixed Mode (Alt. 3)					180,000	15,300	36,500	231,800	92,600	600	17,400	110,600	342,400
Share by Facility (%)								68%				32%	100%
2020 General Capacity (Alt. 4)	65,000	-	13,500	78,500	129,200	15,700	27,000	171,900	89,500	1,000	16,900	107,400	357,800
Share by Facility (%)				22%				48%				30%	100%

NOTES:
- The information presented in this table was directly produced by the model without any post-processing analysis.
- Non-HOVs represent auto vehicles with driver or driver plus one passenger. An average vehicle occupancy factor of 1.33 was used to convert vehicle volumes to person volumes for Non-HOV trips.
- HOVs represent auto vehicles with 3 or more occupants. An average vehicles occupancy factor of 3.15 was used to convert vehicle volumes to person volumes for HOV trips. HOV values represent HOVs on GP and HOV lanes if one exists.
- Note that the 3+ eligible HOVs predicted under the alternatives are significantly higher than the 1995 estimate of 3+ HOVs. This is due to congestion on general purpose lanes parallel to nearly free flow HOV lanes.

Table 5 - Comparative Analysis of Daily Vehicle Volumes on I-5

Location on I-405	1995	2020 No-Action Unconstr.	2020 No Action	2020 Alternative 1	Change vs. NA	2020 Alternative 2	Change vs. NA	2020 Alternative 3	Change vs. NA	2020 Alternative 4			Change vs. NA
										Mainline	Express	Total	
South of SR 524	81,621	163,098	93,317	93,211	0%	128,023	37%	155,703	67%	162,396		162,396	74%
South of 228th St SE	92,822	184,458	108,812	108,463	0%	145,810	34%	174,749	61%	123,257	74,780	198,037	82%
South of County Line	92,822	184,458	108,812	108,463	0%	145,810	34%	174,579	60%	123,147	74,780	197,927	82%
South of NE 124th St	133,176	244,723	153,839	153,448	0%	206,504	34%	245,160	59%	190,161	82,520	272,681	77%
North of NE 85th St	152,174	269,453	183,534	182,513	-1%	227,599	24%	265,992	45%	212,066	82,520	294,586	61%
South of NE 70th St	147,446	225,677	163,108	162,593	0%	202,126	24%	237,779	46%	177,154	95,343	272,497	67%
South of Main St (Bellevue)	164,832	330,078	179,002	176,807	-1%	234,879	31%	294,826	65%	231,559	95,343	326,902	83%
South of SE 60th St	116,525	242,934	123,050	122,728	0%	196,444	60%	250,470	104%	184,005	103,314	287,319	133%
South of SR 169	119,460	252,386	148,110	147,715	0%	209,106	41%	263,335	78%	189,242	103,314	292,556	98%
East of SR 181	103,017	262,296	119,980	118,550	-1%	181,441	51%	231,693	93%	171,875	78,373	250,249	109%

Performance of I-405 Corridor Program Improvements in the Region

The I-405 Corridor Program study area includes 21 percent of the regional population, and produces about 24 percent of the region's trips. This percentage has held relatively constant for the past 30 years and is forecasted to continue for the next 30 years given the current plans and policies in the region. As part of the second level screening for the four action alternatives, the travel demand model was used to examine the effects of improvements by forecasting performance measures such as transit ridership, highway congestion, traffic volumes, and mode share shifts on I-405 and the study area. The transportation performance measures for the region in *Destination 2030* include the cumulative effects of the more prominent transportation improvements proposed in the I-405 Corridor Program. Table H-6 provides a comparison of performance measures.

Table H-6: Performance Measures for Destination 2030 (Regional) and I-405 Study Area

	Destination 2030 (MTP)	1995 Baseline	2020 No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4
VMT (daily total) Region-wide	93,562,322						
VMT (daily total) Study area		16,346,000	22,510,000	22,563,000	24,215,000	25,346,000	26,208,000
VHT (daily) Region-wide	3,226,300						
VHT (daily) Study area		586,000	1,156,000	1,155,000	1,164,000	1,170,000	1,184,000
Mode Share - all trips (weekday)							
SOV	55%	99%	96.00%	96.00%	96.00%	96.00%	96.00%
2+ Carpool	39%	Included above	Included above	Included above	Included above	Included above	Included above
3+ Carpool		1%	2%	2%	2%	2%	2%
Transit	5%	1%	2%	2%	2%	3%	2%
Mode Share - commute							
SOV	56%	95%	84%	83%	83%	83%	83%
2+ Carpool	32%	Included above	Included above	Included above	Included above	Included above	Included above
3+ Carpool	Included above	2%	9%	9%	9%	9%	9%
Transit	12%	3%	7%	8%	8%	8%	8%
Average Speeds in MPH							
AM Peak	35	30	26	26	27	28	29
PM Peak	32	24	13	13	13	14	14
Daily	34	28	19	20	21	22	22

Source: Destination 2030 (MTP):

Destination 2030 adopted May 24, 2001 (Metropolitan Transportation Plan for the Central Puget Sound Region); Technical Appendix 8: Destination 2030 System Performance.

For all other columns including - the 1995 Baseline, 2020 No Action Alternative, and the four Alternatives -- the source is the *I-405 Corridor Program Draft Transportation Expertise Report* (Mirai and DEA, 2001), February 2001.

Table 3.12-3: Results of Transportation Performance Analyses

Evaluation Criteria Performance Measures	Alternatives					
	1995 (Reference)	**2020 No Action**	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
A. IMPROVE MOBILITY						
Serve as much of the 2020 peak period travel demand within the corridor as possible						
Person Volumes by Mode across 3 Screenlines						
PM Peak Period	See Figures 3.12-1A, 3.12-1B, and 3.12-1C; Appendix I, Table 1					
Daily	Appendix I, Table 2; Patterns similar to Peak Period volumes					
Vehicle Volumes by Types of Vehicles						
PM Peak (Avg)	Appendix I, Table 3; Patterns similar to Person Volumes					
Daily (Avg)	Appendix I, Table 4; Patterns similar to Person Volumes					
Daily Traffic along Segments of I-405, by Segment	See Fig 3.12-2; Appendix I, Table 5	See Fig 3.12-2; Appendix I, Table 5	Appendix I, Table 5			
Daily Volume Shifts between Facilities	Refer to Text for Discussion; Alternatives 3 and 4 shift traffic from other corridors (e.g., I-5) as freeway capacity is added.					
Improve predictability of travel times for all modes						
Effects on Travel Time Reliability by Mode	Not Applicable	Qualitative Assessment- Refer to text				
Provide flexibility to accommodate past 2020 travel demands						
Future Flexibility- Ability of Alternatives to Accommodate Post-2020 Demands	Not Applicable	Qualitative Assessment- Refer to text				
Reduce travel times for all modes door-to-door compared with current conditions						
Travel Time - Avg of Sample Trips, in Minutes PM Peak Hour						
General Traffic	49	64	64	60	57	55
HOV	40	48	43	43	43	43
Transit (Walk & Ride/ Park-and-Ride)	102/91	102/93	85/79	85/80	89/81	98/89

Evaluation Criteria Performance Measures	Alternatives					
	1995 (Reference)	2020 No Action	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Reduce the share of peak period and daily trips by single-occupant vehicles						
Modal Shares						
Peak Period (SOV + HOV 2/HOV 3+/Transit %) [a]	Refer to Figures 4-12 through 4-14 in I-405 Corridor Program Draft Transportation Expertise Report (Mirai and DEA, 2001); Appendix I, Table 1					
Bothell [a] (%)	85/14/1	76/23/1	75/23/2	76/22/2	78/20/2	78/20/2
Bellevue [a] (%)	84/15/1	72/25/3	69/24/7	71/22/7	72/23/5	75/23/2
Renton [a] (%)	81/17/2	67/31/2	66/31/3	69/28/3	72/25/3	72/27/1
Shares of Study Area Work Trips (SOV + HOV 2/HOV 3+/Transit %)	Not Estimated	74/19/7	73/19/8	73/19/8	73/19/8	74/19/7
Transit Riders Along Key Segments	Not estimated	Not estimated	Figure 3-12.3	Same as Alt 1	Appendix I, Fig 1	Not estimated
TDM Effects: Non-HOV trip Reduction in % VMT (AM/PM)	10-15/7-10	10-15/7-10	18-21 [b] Both peaks	10-15/7-10	10-15/7-10	10-15/7-10
Provide Effective Connections to Regional and Local Transportation Systems						
Compatibility with Regional Systems	Not applicable	Qualitative Assessment- Refer to text				
Compatibility with Local Systems	Not applicable	Qualitative Assessment- Refer to text				
B. REDUCE CONGESTION						
Reduce Congestion On Study Area Freeways And Arterials Below Current Levels						
Hours of Traffic Congestion (1999)						
I-405 Average	7	7	7	6	5	4
Other Freeways	3	5	5	4	4	3
Arterials	3	5	5	4	4	4
All Facilities Average	4	5	5	5	4	4
Vehicle Miles of Travel -- Daily, in Millions of Miles						
Region	69	101	101	102	102	103
Study Area (Trips within)	16	23	23	24	25	26

Evaluation Criteria Performance Measures	Alternatives					
	1995 (Reference)	2020 No Action	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Vehicle Hours of Travel -- Daily, in Millions of Hours						
Region	2.3	4.0	3.9	3.9	3.9	3.9
Study Area	0.6	1.2	1.2	1.2	1.2	1.2
Average Speed in Study Area, (AM/PM/Daily) mph	30/24/28	26/13/19	26/13/19	27/13/21	28/14/22	29/14/22
C. IMPROVE SAFETY						
Safety [c]						
Fatalities (per 100 Million VMT)	40[d]	56	55	55	54	53
High Accident Location Accident Reduction % (State Routes/Local Streets)	NA	15%/6%	32%/9%	60%/19%	60%/19%	62%/19%
System Level Effects (total accident rate/injury rate – per million VMT)	1.9/1.1	2.1/1.3	2.1/1.3	1.9/1.1	1.8/1.0	1.8/1.0
System Level Effects (total annual accidents – per million VMT)	10,060	13,900	13,840	13,840	13,640	13,310
Nonmotorized Safety Hazard Reductions	Not applicable	0%	53%	53%	53%	47%

[a] Does not include TDM Effects

[b] Alt 1 includes Congestion Pricing

[c] Reduction in Mode Conflicts – This measure was originally part of the safety evaluation criteria. Sufficient data were not available on transit technologies and other project details to evaluate this criterion as part of the programmatic EIS.

[d] Year of reference is 1999

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APPENDIX I
Communications and Coordination

No specific correspondence was received. However, general coordination is presented in Section 2.2.7 of this report.

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